

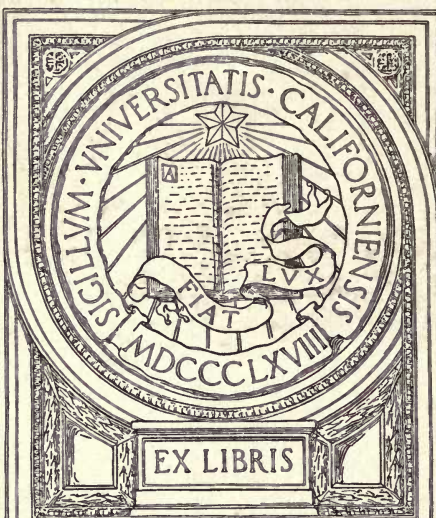
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THE HISTORY

OF

VESUVIUS

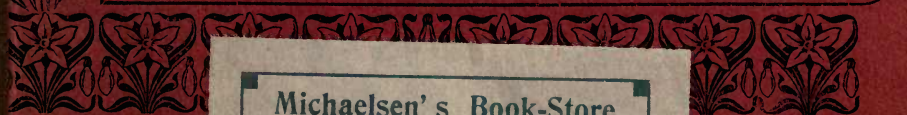
FROM A. D. 79 TO A. D. 1907

BY

T. A. SCHNEER

Nature glorious in beauty,
Terrible awful in wrath,
Trembling in wonder before thee
Man in his impotence bends.

E. v. Stein - Nordheim.



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THE HISTORY
OF
VESUVIUS

FROM A. D. 79 TO A. D. 1907

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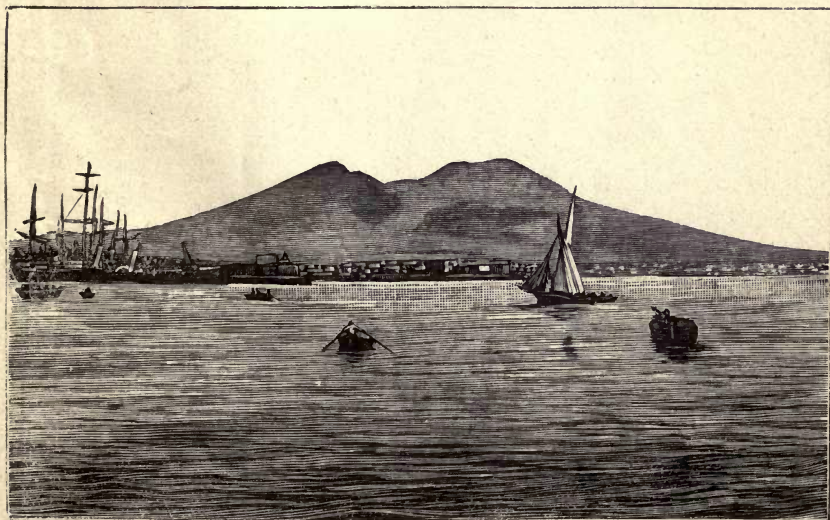
T. A. SCHNEER

With numerous illustrations from ancient sources

Nature glorious in beauty,
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MOUNT VESUVIUS 1907

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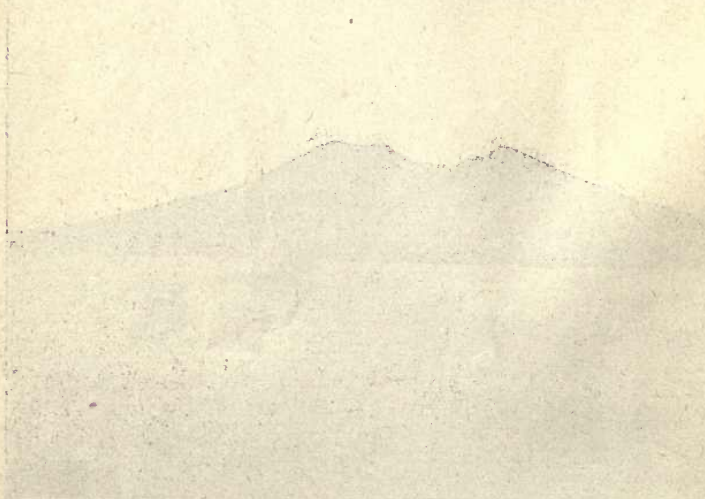
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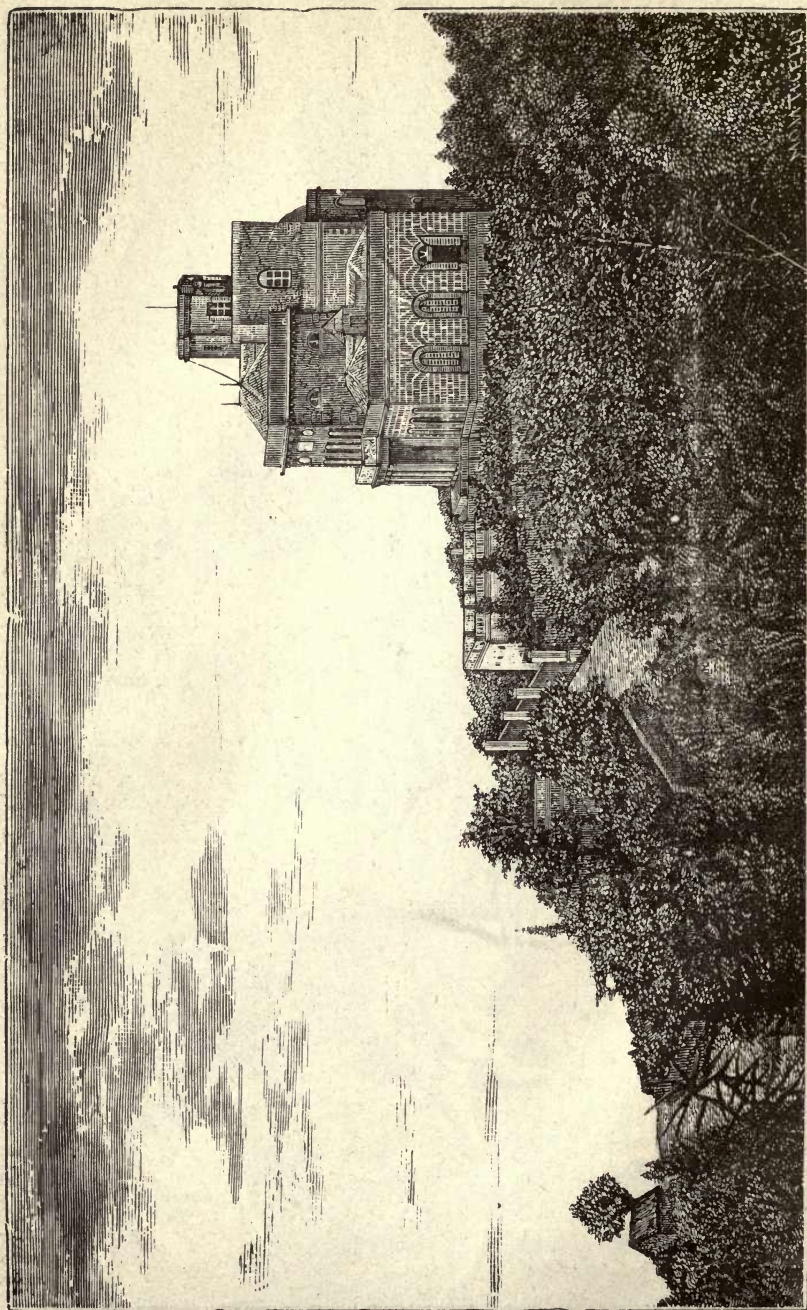
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Dedicated to the Memory of my beloved Mother
Baroness E. Schneer von Stein — Nordheim.

THE AUTHOR.

5, *Viale Principessa Elena*
Naples 1907.



FORMER ASCENT OF MOUNT VESUVIUS
Plate 1.



THE OBSERVATORY
Plate 2.

P R E F A C E

This History of Vesuvius was begun by my beloved mother Baroness E. von Stein-Nordheim and finished by me with the account of the Vesuvian activity of these last 16 years.

T. A. SCHNEER.

INTRODUCTION

To King Ferdinand II of Naples belongs the honor of having been the first to found an meteorological Observatory. As it was imagined that the proximity of an active Volcano might have some influence on the variations of the atmosphere a spur of Vesuvius called « i Canteroni » was chosen at its site. It stands 600 metres above sea-level, is one Kilometre distant from the Vesuvian cone, and two from the centre of the great crater. The building of this handsome edifice, designed by an engineer Gaetano Fazzini by name, was begun in the year 1841 and finished in 1847; but owing to the political troubles of the time, it was not opened until 1855 in which year it was placed under the direction of Professor Luigi Palmieri under which it remained till 1896 the year in which Prof. Palmieri died. Prof. Eugenio Semmola was his successor and had the direction till 1903 when Prof. R. V. Matteucci took the direction of the Observatory. This illustrious man, whose name has become a household word far beyond the bounds of his native land has carried on his observations there for these last 4 years with untiring zeal and energy. Lava floods might threaten distruction to that outpost of research, showers of stones, blinding ashes and suffocating vapours endanger his life, but, in spite of all, this dauntless disciple of science, kept faithful watch on the post entrusted to him, like a general on the field of battle. With the greatest care and exactitude he has noted every varying phase before during and after the eruptions of Vesuvius. His notes and observations contribute many a valuable corner stone to the edifice of volcanic theory.

The Observatory is rather short in funds. Nevertheless the zeal of its directors has provided it with very valuable instru-

ments and every necessary apparatus. We call the reader's particular attention to the electric-magnetic seismograph and the bifilar electrometre (Palmieri's invention). The first of these instruments notes with the utmost exactitude the slightest movements of the ground, also the direction of the movement and the time occupied by it. The other is used to measure the electricity in the atmosphere a matter of special importance during an eruption. There is also a valuable library attached to the institution and it possesses a very interesting collection of minerals and of all the various kinds of ashes fallen since 1855. There is also a laboratory for the necessary chemical analyses.

It has been ascertained that hitherto, during the various eruption, 70 kinds of minerals have been ejected. The collections and seismical apparatus are shown and explained to visitors, if desired, in the most obliging manner.

As in the following pages words and expressions not familiar to the reader must of necessity be used, we subjoin a few explanations not only of single words, but also of the ejecta from the constantly recurring eruptions.

SMOKE. — The smoke rising from the lava, and issuing with it from the erupting mouths is frequently, especially at the beginning and end of a conflagration, accompanied by sulphuretted hydrogen, hydrochloric acid, and sulphurous anhydride. Should there be a heavy rainfall at the time, these gases unite with the water and produce a destructive effect on every plant touched by it. When the eruption is at its height these gases disappear.

LAVA. — This is the principal element in the Vesuvian eruptions. It is a substance rendered fluid by the action of fire or water and then ejected from an opening in an active volcano. When first emitted, it has a heat of 1000° centig. It remains fluid up to 700°. At a red glow it is tough and pliable, and on cooling down it becomes very hard and brittle. All volcanic lavas have the same constituents, such as silicates, iron, aluminium, copper, lead, gypsum, soda, etc. The only difference between them consists in the various crystals they contain. The flow of the lava is rapid or slow according to the violence of the eruption, the degree of heat, the quantity of scoriae carried along with it, and the steepness of the road it takes in descending.

LAVA-CANALS. — During eruptions, fissures are formed in the interior of the volcano, into which lava forces an entrance, and then, according to the character of the cleft, (as, for instance, if it opens to the outside) oozes out, or, if the fissure does not get beyond the interior of the mountain, cools inside, and thus forms the so called lava-canals.

ASHES. — The Vesuvian ashes are composed of the finest dust-particles of various colours, frequently mixed with sublimations. These latter are, however, soluble in water, and the ashes remaining are then proved to be of identical substance with the lava. Properly they might be called Lava-dust.

LAPILLI — are infinitesimally small stones thrown out in quantities by the mountain in eruption. Pompei, for instance, is, for the most part buried under lapilli of the sort principally formed from fragments of pumice. The lapilli of later eruptions differ from the Pompeian so called black lapilli, in colour as well as substance. They are generally characterized as white lapilli, and much used for filling up crevices in building.

PROIECTILES — are red-hot pasty fragments of lava, sometimes of considerable size, projected from the crater during an eruption, and appearing, at a distance, like glowing sparks amid the smoke.

BOMBS — consist of fragments of old lavas enclosed in new lava. They are sometimes round, sometimes oval, and are often shot up to a great height.

SCORIAE — are fragments of rough vesicular lava, that is to say full of holes caused by air-bubbles.

FUMAROLE — or smoke-funnels, are cracks in the lava from which vapours escape. They form a link between the cooled surface and the still glowing lava beneath. Their duration is shorter or longer according to the depth or shallowness of the lava on which they are formed.

They can go on smoking for weeks, months and even years. These evaporations are at first neutral in character, but their properties change according to the length of time they have been going on. Hydrochloric acid appears first, then sulphurous acid, and finally sulphuretted hydrogen. During the neutral period a

white deposit, namely common salt, is found at the edges of the fumarole, as well as a black one, namely oxide of copper, and, under certain conditions, sal ammoniac. As it would lead too far to give a longer dissertation on the chemical deposits of the fumarole, we must refer the reader, anxious for more exact information, to the writings on the subject of various scientists.

MEPHITIC VAPOURS — are exhalations of carbonic acid gas which are fatal to respiration both in man and beast. They are frequently found on the slopes of Vesuvius, especially after great eruptions. When these vapours gather round the roots of a plant it will wither and die.

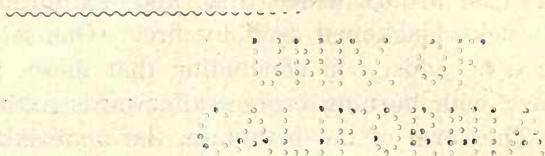
Moss — The lichen *Vesuvianum* is a variety of moss which forms on the lava, giving thus the first token of reawakening fecundity in the soil below. It forms most plentifully on the scoriated lava which covers land formerly in a state of cultivation, and is first seen from 5-6 years after the superficial cooling of the lava.

Although this little work makes no pretence to having been written for scientists, and is only a narrative of facts and events which cannot fail to be of interest to cultivated readers, still a close study of the very extensive literature in connection with Vesuvius, was necessary for its production. We therefore subjoin a list of all the writings, in number over seventy, consulted by us on the subject.

HISTORICAL SKETCH

OF

MOUNT VESUVIUS



Who is there, visiting Naples for the first time, who does not look eagerly forward to the moment which will bring him face to face with Vesuvius, the only active volcano of the European continent. Solemn is the impression made on the distant beholder when that moment arrives. Massive and grand, surmounted by a pillar of smoke, Vesuvius stands out against the clear sky, forming a dark and gloomy background to the blue sea, the fruitful fields, and the gleaming city beyond, which lies smiling at its feet as if in defiant mockery. Still more impressive is the scene by night when we see flames rising and falling amid the smoke, now shooting upwards like a sheaf of fiery darts, disappearing with equal suddenness, then blazing up anew with redoubled force, or remaining steadily, for a time, like a crown of fire on the mountain-top. When, in addition, a stream of glowing lava flows slowly down, like a broad red banner, from a rent in the mountain's side, there are few who will not contemplate with shuddering awe the working of those hidden forces of nature which proclaim to us clearly, though in an unknown tongue, the existence of that mysterious inner fire which burns on for ever in the centre of our terrestrial ball.

Times without number has this mountain, as if in wrath, spread sorrow and desolation over the surrounding country and its inhabitants. We can trace back its history, by the help of the authors and chroniclers of the different centuries, to the terrible year 79 of the Christian era, when, as we learn from the writings of contemporaries, it awoke from long repose and, vomiting rivers of fire, destroyed several flourishing cities, burying them so completely that, even in Plutarch's time, there was nothing to indicate where they had stood.

Whether on account of its form, or from tradition, it is certain that all the ancient writers, such as Lucretius, Vitruvius, Strabo, and Diodorus Siculus, unite in describing it as an extinct volcano. Diodorus, for instance, who lived in Julius Caesar's time, in his *De Antiqui*, lib. IV, says that Vesuvius, like Etna, belched fire at one time, while Strabo, who lived in the time of Augustus, describes the Vesuvius of his day as a mountain surrounded by fertile fields; the upper part, mostly flat, being, however, quite barren, of a dark ashen tint, and exhibiting crevices, caverns and rocks blackened as if by fire. « One is quite justified therefore », he adds, « in concluding that these parts were once all ablaze with burning craters afterwards extinct for want of fuel ».

The form of the mountain, the materials of which it is composed, the various kinds of lava which, like veins of ore, inlay the walls of the ancient crater, all testify to the fact that Vesuvius was formerly a volcano. It must have been submarine at that time, the fire making itself a path through the rocks at the bottom of the sea, which would account for the sea-shells found among the formations of Mount Somma, and for the splendid examples of metamorphosis often showing themselves in its erratic blocks. It had evidently a prehistoric age of activity followed by long repose, as distinguished from a historic or modern one represented by the Vesuvian cone and its lava. The seat of its fires is, however, the same, and, as from the bottom of a crater of Vesuvius, as at present existing, a new eruptive cone arises, so we may imagine that from the floor of the ancient crater of Mount Somma the actual Vesuvian cone was heaved up at the commencement of the historic era of the volcano's renewed activity.

It is interesting to know that the streets of Pompeii were paved with Vesuvian lava, and that, among the ruins of Herculaneum, some still more ancient remains have been found, justifying the belief that a former city existed there and was destroyed by the working of prehistoric eruption.

Mount Vesuvius, as seen from Naples, or from any point whatsoever of the road leading to its base, and from thence to the Observatory and crater, presents the appearance of a double or bifurcated mountain. At the height of little more than 700 metres above the level of the sea this division into two summits, takes place. The one to the right of the traveller has the form of a cone of sand and lava from the upper part of which smoke, often accompanied by fire, is almost always ascending.

This is, strictly speaking, Vesuvius, or the Vesuvian cone. The other one, which looks towards it, is formed of almost vertical rocks surrounding the cone aforesaid to half its circumference, and running, on the north, from west to east. The outer side is moderately sloping, and covered with luxuriant vegetation.

To form an idea of the configuration of this part, which is called Mount Somma, let us imagine it without the Vesuvian cone. Somma would then appear as in plate 3., where it is easy to recognize a spacious crater open to the south and running from west to east, from within which has arisen the present gigantic cone.

Mount Somma with the ample crater above indicated, represents the ancient Mount Vesuvius as described by Strabo, when no longer burning: that is to say, the prehistoric volcano. The upper part mentioned by the old geographer must have been its almost level bottom, a large part of which was still remaining as a sort of flat cincture round the new cone at the time of its upheaval. To this cincture various names were given of which we will speak presently.

The name of Vesuvius is probably derived from the Greek word βεσβιος, Galen writes Bespius, evidently signifying its volcanic nature. That of Somma, according to an ancient tradition, comes from Summanus, an obscure old god, ruler of night and shadows.

Several geologists, taking their stand on some expressions of Dion's or rather of Xifilino's, who abridged his works, represent the edge of the crater as being of an equal height all round. But, apart from the many reasons which might be adduced to the contrary, it is enough to remember that Spartacus and his companions, B. C. 73, having descended by means of ropes made of vine-suckers, would have found themselves, in that case, quite shut in, and had 'difficulty in sallying out to attack their enemies' encampment posted on the slopes of Mount Somma.

Every thing induces us to believe the Vesuvian cone appeared, though not in its present altitude, in the year 79 of the christian era, when a new period succeeded to the prehistoric one. This is why all the ancient writers speak of Vesuvius as of one mountain only. It is only in later times that they mention the double summit.



VESUVIUS AT THE TIME OF SPARTACUS AND STRABO
Plate 3.

G. Agricola in his book *De natura eorum quae e terra*, writes in the year 1545: « Verticis pars sinistra (Somma) altior est et angustior dextra (Vesuvian cone) humilior et latior unde proculeum aspicientibus apparet biceps esse. » We see from this that Vesuvius in 1545 was lower than Somma, whereas it is now about 100 metres higher.

That first and well-known awakening forms a fitting commencement to our story.

This famous eruption took place on the 23rd of November A. D. 79, during the reign of the Emperor Titus. We have the testimony of an eyewitness of the terrible catastrophe in the person of the younger Pliny, nephew of the great geographer and admiral of the same name, Pliny the elder, who, in the two following letters to his friend Tacitus, gives a wonderfully graphic account of it:



VESUVIUS AT THE TIME OF THE ERUPTION OF A. D. 79

Plate 4.

Pliny's letters to Tacitus.

I.

« You ask me to write you an account of my uncle's end, in order that you may be able the more faithfully to transmit it to posterity. I thank you, as I see that his death, if commemorated by you, has an imperishable renown offered it. For, though he fell amid the destruction of such fair regions, and seems destined to live for ever — like so many peoples and cities — through the memorable character of the disaster; though he himself was the author of many and enduring works; yet the immortality of your writings will add greatly to the uninterrupted continuance of his fame. For my part I deem those blessed to whom, by favour of the gods, it has been granted either to do what is worth writing of, or to write what is worth reading; above measure blessed those on whom both gifts have been conferred. In the latter number will be my uncle, by virtue of his own and of your compositions. Hence, I the more readily undertake, and even lay claim to perform what you request.

He was at Misenum, in personal command of the fleet. The ninth day before the Kalends of September, at about the seventh hour

my mother indicated to him the appearance of a cloud of unusual size and shape. He had sunned himself, and next gone into his cold bath; and, after a light meal, which he took reposing, was engaged in study. He called for his sandals, and ascended to a spot from which this portent could best be seen. A cloud was rising, from what mountain was a matter of uncertainty to those who looked at it from a distance; afterwards it was known to be Vesuvius—whose appearance and form would be represented by a pine better than any other tree. For, after towering upwards to a great height with an extremely lofty stem, so to speak, it spread out into a number of branches; because, as I imagine, having been lifted up by a recent breeze, and having lost the support of this as it grew feebler, or merely in consequence of yielding to its own weight, it was passing away laterally. It was at one time white, at another dingy and spotted, according as it carried earth or ashes. To a man of my uncle's attainments, it seemed a remarkable phenomenon, and one to be observed from a nearer point of view. He ordered his fast-sailing cutter to be got ready, and, in case I wished to accompany him, gave me leave to do so. I replied that I preferred to go on with my studies, and it so happened that he had himself given me something to write out.

He was in the act of leaving the house, when a note was handed him from Rectina. Caesius Bassus, frightened, together with the people there, at the imminence of the peril (for his villa lay under the mountain, and there was no escape for him except by taking a ship), begged my uncle to rescue him from so critical a situation. Upon this he changed his plan, and, having started on his enterprise as a student, proceeded to carry it out in the spirit of a hero. He launched his four-ranked galleys, and embarked in person in order to carry assistance, not to Rectina only, but to many others, for the charms of the coast caused it to be much peopled. He hastened in the direction whence every one else was flying, holding a direct course, and keeping his helm set straight for the peril, so free from fear that he dictated and caused to be noted down, as fast as he seized them with his eyes, all the shiftings and shapes of the dreadful prodigy. Ashes were already falling on the ships, hotter and thicker the nearer they approached; and even pumice and other stones, black, and scorched, and cracked by the fire. There had been a sudden retreat of the sea, and the debris from the mountain made the shore unapproachable. Having hesitated for a moment whether to turn back, he shortly called out to the helmsman (who was urging him to do so), « Fortune favours

the brave ! Make in the direction of Pomponianus » . The latter was at Stabiae, separated from him by the whole width of the bay, for the sea flows in by shores gradually winding and curving inwards. There, in view of the danger which, though it had not yet approached, was nevertheless manifest, and must be upon them as soon as it extended itself, he had got his effects together on board ship, resolved to fly, if only the wind left off blowing from the opposite quarter. My uncle, brought to shore by this same wind, which precisely favoured him, embraced his trembling friend consoling and exhorting him, and, in order to calm his fears by his own sang froid, bade them conduct him to the bath. After bathing, he took his place at table, and dined gaily, or (which was equally heroic) with an air of gaiety.

Meanwhile, from many points of Mount Vesuvius, vast sheets of flame and tall columns of fire were blazing, the flashes and brightness of which were heightened by the darkness of night. My uncle, to soothe the terrors of those about him, kept telling them that these were fires which the frightened country people had left to burn, and that the deserted houses were blazing away all by themselves. Then he gave himself up to repose, and slept a perfectly genuine sleep, for his snoring (which, in consequence of his fullhabit, was heavy and loud) was heard by those in attendance about his door.

However, the courtyard from which this suite of rooms was approached was already so full of ashes mixed with pumice-stones that its surface was rising, and a longer stay in the bedchamber would have cut off all egress. On being aroused, he came forth and rejoined Pomponianus and the others who had kept watching. They consulted together whether to remain under cover or wander about in the open; for the walls nodded under the repeated and tremendous shocks, and seemed, as though dislodged from their foundations, to be swaying to and fro, first in one direction and then in another. On the other hand, in the open air, there was the fall of the pumice-stones (though they were light and burnt out) to be appended. However, a comparison of dangers led to the choice of the latter course. With my uncle indeed it was a case of one reason getting the better of another; while in the case of others fear overcame fear. They covered their heads with pillows tied round with cloths: this was their way of protecting themselves against the shower. By this time it was day elsewhere, but there it was night, the blackest and thickest of all nights, which, however, numerous torches and lights of va-

rious kinds served to alleviate. It was decided to make for the shore, in order to learn from the nearest point whether the sea was by this time at all available. A huge and angry sea still continued running. Here, reclining on a cloth which had been thrown on the ground, my uncle more than once called for a draught of cold water and swallowed it. Upon this, an outbreak of flame and smell of sulphur, premonitory of further flames, put some to flight and roused him. With the help of two slave-boys he rose from the ground, and immediately fell back, owing (as I gather) to the dense vapour obstructing his breath and stopping up the access to his gullet, which with him was weak and narrow and frequently subject to wind. When day returned (the third from that which he had looked upon for the last time) his body was found whole and uninjured, in the dress he wore; its appearance was that of one asleep rather than dead.

Meanwhile my mother and I at Misenum — however, this has nothing to do with history, nor did you wish to learn anything except what related to his death. So I will make an end. This alone will I add, that everything related by me has been either matter of personal observation or else what I heard on the spot, the time of all others when the truth is told. Do you select what you choose. For a letter is a different matter from a history; it is one thing to write to a friend and another to write for the world.

II.

You say that the letter I wrote you, at your request, on the subject of my uncle's death has made you wish to know what I myself, when left behind at Misenum — for with the mention of this I broke off — had to go through, not merely in the way of alarms, but of actual adventures.

« Though memory shuns the theme, I will begin. »

After the departure of my uncle I devoted what time was left to study (it was for that I remained behind); the bath shortly followed, then dinner, then a short and troubled sleep. There had been heavings of the earth for many days before this, but they produced the less apprehension from being customary in Campania. On that night, however, they so much increased that everything seemed not so much to be in motion as to be turned upside down. My mother rushed into my room; I was similarly getting up with the intention of arousing her in case she was asleep. We sat down

in a courtyard attached to the house, which separated by a small space the dwelling from the sea. I do not know whether to style it intrepidity or imprudence on my part, seeing that I was only in my eighteenth year; however, I called for a volume of Livy, and read it as though quite at my ease, and even made extracts from it, as I had begun to do. Upon this, a friend of my uncle's, who had lately come to him from Spain, when he saw my mother and me seated, and me reading into the bargain, reproved her for her apathy and me for my insensibility to danger. None the less diligently did I devote myself to my book. It was now seven o'clock in the morning, yet still there was but a kind of sickly and doubtful light; now, too, that the surrounding building had been shaken, as the place in which we were, though not under cover, was of small dimensions, there was a great and unavoidable risk of our being overwhelmed. Then, at last, we decided on leaving the town. The mass of the inhabitants followed us terror-stricken, and (an effect of panic causing it to resemble prudence) preferring the guidance of others to their own, they pressed on us, as we were making off, and impelled us forwards with their crowded ranks. When we had got beyond the buildings we stopped. There we experienced much that was strange, and many terrors. For the vehicles which we had ordered to be brought, out, though standing on a perfectly level plain, were rocking from one side to the other, and would not remain still in the same place even when propped under with stones.

Moreover, we saw the sea sucked back into itself, and repulsed as it were by the quaking of the earth. The shore had certainly encroached on the sea, and retained a number of marine animals on its dry sands. On the other side of us a black and terrible cloud, broken by the zig-zag and tremulous careerings of the fiery element, was parting asunder in long trains of flame: these were like lightning, but on a larger scale. Then, indeed, the abovementioned friend from Spain became more urgent and pressing. « If », said he, « your brother and your uncle is alive, it is his wish that you should be in safety; if he has perished, it was his wish that you should survive him. Why then hesitate to escape » ? We replied that we could not so act as, while uncertain of his safety, to provide for our own. Without further delay he rushed off, and got out of reach of danger as fast as he could.

Not long after, the cloud in question descended on the earth and covered the sea. Already it had enveloped and hidden from view Capreae, and blotted out the promontory of Misenum. Upon

this my mother begged and prayed and even ordered me to make my escape as best I could, it being in my power as a young man to do so; as for herself, retarded by her years and her frame, she was well content to die provided she had not been the cause of my death. I, on the other hand, declared that. I would not be saved except in her company, and clasping her hand I compelled her to quicken her pace. She obeyed with reluctance, blaming herself for delaying me. And now came a shower of ashes, though as yet but a thin one. I looked back; a dense mist was closing in behind us, and following us like a torrent as it streamed along the ground. « Let us turn aside », said I, « while we can still see, lest we be thrown down in the road and trampled upon in the darkness by the crowd which accompanies us ». We had scarcely sat down when night came on, not such as it is when there is no moon, or when there are clouds, but the night of a closed place with the lights put out. One could hear the shrieks of the women, the cries for help of the children, the shouts of the men: some were calling for their parents, others for their young ones, others for their partners and recognizing them by their voices. Some were lamenting their own case, others that of those dear to them. There were those who, through fear of death, invoked death. Many raised their hands to the gods, but the greater number concluded that there were no longer gods anywhere, and that the last eternal night of story had settled on the world. Nor were there wanting those who by imaginary and false alarms increased the real dangers. Some present announced that such and such a part of Misenum had been overthrown, or such another was in flames; falsely, yet to believing ears. There was a little light again, but this seemed to us not so much day-light as a sign of approaching fire. Accordingly there was fire, but it stayed at a considerable distance from us, then darkness again and a thick and heavy shower of ashes. We got up from time to time and shook these off us; otherwise we should have been covered with them and even crushed by their weight. I might make a boast of not having suffered to escape me either a groan or a word lacking in fortitude, in the midst of such perils, were it not for the fact that I believed myself to be perishing in company of all things, and all things with me, a miserable and yet a mighty consolation in death.

At last, this black mist grew thin, and went off into a kind of smoke or haze; soon came real day, and the sun even shone forth, luridly however, and with the appearance it usually wears

under an eclipse. Our yet trembling eyes saw everything changed and covered with deep ashes as with snow. We returned to Misenum, and refreshed our persons as best we might, and there spent a night of suspense alternating between hope and fear. Fear prevailed, for the quaking of the earth continued, and many persons, crazy with terror, were sporting with their own and other's misfortunes by means of the most appalling predictions. Yet not even then, after experiencing and still expecting perils, did we think of going away till news came of my uncle. All this, which is in no way worthy of history, will be for you to read, not to write about, and you must lay it to your own account (since it was you who called for the communication) if it should seem to you not even worthy of a letter ».

During this momentous eruption there does not seem to have been any flow of lava. Pompeii is buried under lapilli, and Herculaneum under sand and ashes converted by the action of time and water into tufa. In later ages a stream of lava flowed over the latter, forming thus a solid crust above the buried city.

After this first memorable eruption, it would appear, from the silence of historians, that Vesuvius remained tranquil up to the year 203, when, during the reign of the Emperor Severus, according to Dion and Galen, a great conflagration took place accompanied by bellowings which were heard as far as Capua. This phenomenon seems to have lasted 8 days.

There were many other minor eruptions in years nearly corresponding to 243, 305, and 321, if we are to believe Procopius, Troilus, Sigonius and others. That of 305, says Baronius, caused such terror in Constantinople that a day of fasting and prayer was decreed.

On the 6th. November 472, or, according to others 471, another great eruption took place which continued, says Procopius (lib. 11) to the year 474. It is told that the ashes from this conflagration reached as far as Constantinople, and that the Emperor Leo I. was so terrified by this that he thought of flying the city.

We hear, for the first time, of the appearance of lava during the eruption of 512, when it caused such damage as to induce Theodric, King of the Goths, to remit the taxes to all who, had suffered injury by it and the ashes. Procopius, who in the year 534, accompanied the famous¹ Belisarius to Italy, mentions this. It is considered by most authors to be the fourth eruption from the year 79.

Another eruption took place in the month of March 685, according to Sabellicus, Sigonius, and Paulus Diaconus, during the reign of the Emperor Constantine IV.

In the year 993, according to Baronius, who cites Rudolf Glaber, a monk of Cluny, another eruption took place, the particulars of which are wanting.

In the chronicle of Anonimus Cassinese (apud P. Carracciolo fol. 49 et 137), the History of Falco Beneventanum, as well as in the accounts given by Leo Marsicano, a monk, afterwards cardinal and archbishop of Ostia, and still known in history as Leo Ostiensis, we read of eruptions in the years 1036, 1049, and 1138-39. The first mentioned author, and Andreas Scoto, who relates it in his « Itinerary of Italy » speak of copious streams of lava flowing in the year 1036, not only from its sides, and from thence down to the sea. The latter tells us of a stream of sulphurous resin or bitumen which flowed down to the sea where it became petrified. According to St. Pietro Damiano, a monk of Camaldoli, afterwards Cardinal, who lived at the time, this eruption, which must have been a very important one, lasted up to 1038.

He describes it in a small work, in which he tells the following quaint story:

In a rocky cell, not far from the highroad to Naples, lived a holy hermit. Sitting one night by the door in pious meditation, he saw some wild looking men, black as soot, driving before them beasts of burden laden with hay and straw. Curious to know what this might mean, he asked whither they were going: « Ho ho »! cried they, « devils are we, » « This fodder is not for beasts but for men. We are going to make up a fire with it so as to be ready for Prince Pandolfo of Capua and the great Captain Giovanni of Naples ». The hermit when he heard that was sore afraid. Next morning he went to Giovanni and told him all he had seen and heard. Now the Emperor Otto II had just come to Italy to fight the Saracens. Giovanni took the hermit's story mightily to heart and said: « I will first see the Emperor and treat with him as to the continuance of the kingdom of Naples; after that I will forsake the world, become a monk, and do penance for the rest of my life ». But, wishing to know for certain how the matter stood with Pandolfo, he sent a messenger to Capua, and behold it was found that he died in the night. This notwithstanding, the great Captain neglected the hermit's warning and, sooth to say, 14 days thereafter, died in

his sins without shrift, and unrepentant. Now that both evildoers were dead, terrible flames blazed from the mouth of hell which is Mount Vēsuvius, insomuch that all could see that this was the fire prepared for them by the devils.

The holy man tells us further that the Prince of Salerno, on seeing the flames blaze from the mountain-top, said: « Verily, another great sinner must be about to die and pass through the gate of Hell ». But, behold it was he himself who was cut off that selfsame night in his sins, with no time for repentance. The same night in which he gave up the ghost his dead corps was observed to stink horribly. From this time forth never yet died anyone of princely rank and very evil life that flames did not issue from Vesuvius, followed by a stream of burning pitch and sulphur, running down to the sea and setting fire to the very water.

It is interesting to know that this superstition still exists among the Neapolitan. When the mountain gets restless and throws out smoke and fire, they will say: « Behold another great sinner going to his account ».

Leandri Alberti, in his « Description of Italy », speaks of an eruption in 1306. This has, however, been called in doubt by various authors.

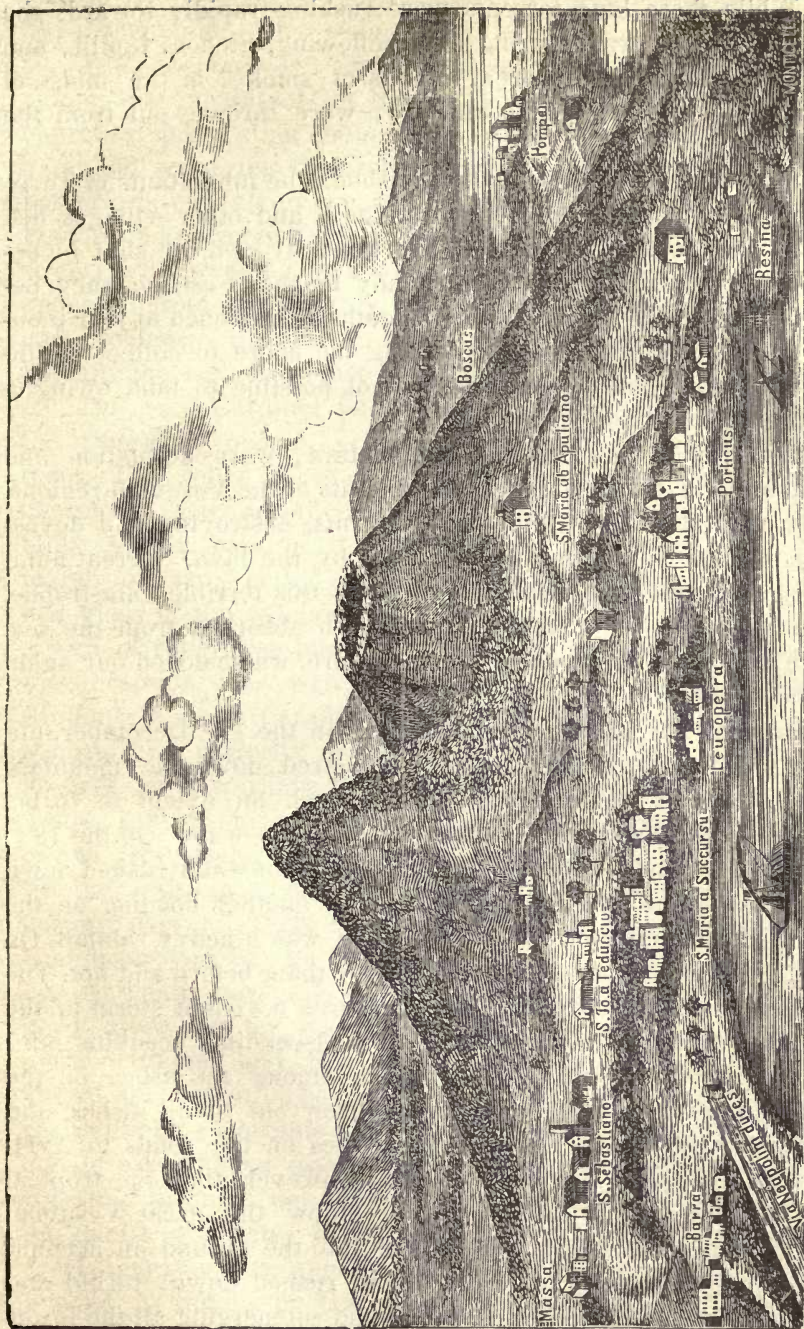
Leone di Nola in his « Storia di Nola » lib. I N. 7. mentions an eruption said to have taken place in the year 1500; but strangely enough, no notice whatever is taken of it in the chronicles of the time. Its authenticity has, with good reason, been called in doubt, seeing that Magliocco and others, who were contemporaries, give an accurate description of the interior of the crater shortly before the memorable eruption of 1631. They speak of it as covered with trees, and having at the bottom, three springs of water, one of which was hot and bitter, another hot and tasteless, and the third very salt. To reconcile accounts Ignazio Sorrentino thinks it might have been an eruption of ashes alone from a small cone called Viulo near Bosco, and another, called Fosso della Monaca, of the origin of which we are ignorant.

Un to now, as we see, the notice of the Vesuvian conflagrations have been very insufficient. The volcano had fallen into a state of repose after 1139 or, if you will, from 1306, but awoke again with great violence in 1631. Then began a new era of activity sufficient to call the attention of authors to it. Every eruption after that date has had its own special historians. The only thing wanting was precise information as to the state of the mountain previous to a new outbreak. The crater of Vesuvius,

fortunately visited previous to December 1631 by Braccini and others, shewed, as has been said, signs of long repose. The former says that it must have had at that time a circumference of about 1578 metres. The trees in the interior, the slight activity of the fumarole, or smoke funnels, placed Vesuvius in the category of a semi-extinct volcano. Wide Pasturelands extended to the very cone, and, in consequence, the space separating it from the scorched rocks of Mount Somma, at one time called the *Val-lone* or great valley, now *Atrio del Cavallo*, was occupied by shepherd's huts.

In plate 5, copied from an original drawing of the time, we see what Vesuvius was like before it again became active.

Whether because no one was prepared for such an event or because the summit of Vesuvius was covered with clouds, no premonitory signs of the terrible catastrophe approaching were observed. Still, according to evidence not to be despised, various subterranean noises were heard, especially at night, before the eruption became manifest. These were thought to come from the rushing of the water of the traditional underground river *Dragone*. Some noticed that the water in the wells had either diminished or become turbid. Even the animals feeding on the mountain often took to flight in wild terror. There were frequent tremblings of the ground. A few days before the bursting out of the conflagration, some persons who had gone up to the top of Vesuvius from Ottajano and Torre, saw that the floor of the crater had risen to its rim. The trees inside were either destroyed, or heaved up amid a mass of muddy soil. Still no one imagined what was coming, until, on the 16th December 1631, the cone burst open with great impetuosity, not only at the summit but at the sides, and the most memorable eruption of our volcano since that of 79 took place. From these rents lava in great quantities flowed downwards in different direction, advancing so far into the sea that, at night, it almost seemed as if on fire. This is why we find written on the drawings of the time: « *Mare ardere visum* », Jorio, Portici, a large part of Resina, Torre del Greco and St. Giorgio a Cremano were destroyed. Any one taking the train from Naples to Torre dell'Annunziata may see cuttings of this lava at Granatello, at Scala (Torre del Greco, etc. He will then have an idea of the great extent of this lava-stream, which furnished later, rich material for street-paving and house-building. The streets of Naples are in great part paved with the lava of 1631.



VESUVIUS BEFORE THE ERUPTION OF 1631

Plate 5.

While these lava-torrents were rushing rapidly towards the sea the volcano was roaring and bellowing. Stones, lapilli, and ashes accompanied by great clouds of smoke, in the midst of which lightnings darted to and fro, were thrown out from the different openings.

Six thousand head of cattle perished. The inhabitants of Torre del Greco, Resina, Portici, Pietrabilanca and other villages fled but, either struck by projectiles, overtaken by lava, or shut in between two torrents of fire without any means of escape, they perished miserably. The number of deaths is reckoned at four thousand. The viceroy sent galleys along the shore to collect the fugitives. But at many points it was not possible to land owing to the fire still burning in the water.

Not only by fire, at this conjuncture, were desolation and death brought to the unhappy inhabitants of the Vesuvian regions. Water poured down in impetuous torrents, destroying and devastating houses and farms not invaded by the lava. A great number of contemporary authors, writing of this terrible catastrophe, affirm that this water after having been absorbed from the sea, which was seen to recede from the shore, was belched out again by the mountain.

Braccini for instance, tells us that, on the 17th December, under a cloudless sky, floods of water poured down the mountain sides inundating the fields of Nola to such an extent as to be, in some parts, 4 metres deep. It tasted like sea-water. On the 18th, the weather being still fine, similar torrents of water rushed down towards Ottaviano, Resina etc. There was another flooding on the 24th on the evening of which day there was a heavy rainfall. On the 31st there was another flood clearer than before and hot. The weather changed, however, and there was a violent storm in the night. Braccini tells us further that, on ascending Vesuvius after these inundations, he found seashells among the ashes on the Atrio. Others relate that Vesuvius threw out small fishes and seaweeds which were found in quantities on the roads to Avelino and Atripalda. Palmieri believes, however, that the tropical rains, which usually accompany or follow the great Vesuvian conflagrations, not being able to sink into the ground on account of the quantities of ashes covering it, rushed down, turbid and wild, over every declivity, engulfing and submerging all the lower parts. If other proof were wanting to justify this assumption, he adds, the exemption from taxes of some village such as Monteforte, Forino, Atripalda, Vulturara, Serino and Solofra on the other

side of the Appenines, would suffice, as they certainly could not have been injured by waters from Vesuvius.

This melancholy occurrence aroused the greatest horror among the inhabitants of Naples. The populace rushed into the churches, prostrating themselves before the altars, tearing their hair, and scourging themselves until the blood came. There were not priests enough to receive the confessions of all the penitents. People of known evil life even proclaimed their sins aloud in the streets with weeping and lamentations. But when a proclamation appeared from the Viceroy strictly prohibiting indulgence in vice and profligacy, the terror of the people knew no bounds: they thought the last day must be at hand.

The good Cardinal Buoncompagno did what he could to calm the trembling people. « Pecorelle attimorate » as Martino calls them. The relics of St. Januarius were carried from church to church in solemn procession, even the Viceroy and all the nobility taking part in it. On returning to the cathedral, after a march of many hours, a gleam of sunlight fell through the stained glass of the window. This was hailed as a happy omen, and a sigh of relief was audible at this sign of grace. The history of this eruption was written by a great many authors Braccini, Giuliani, Muscoli, Carafa and other. The government, resolving to transmit to posterity a lasting memorial of this terrible event, as well as a warning to the people to be more prudent for the future, put up on the high road to Portici, at the corner turning off to Granatello, a monumental stone with a Latin inscription. Another was placed, also on the high road, at a spot in the eastern part of Torre del Greco where a former memorial had been destroyed by the lava.

Authentic accounts of the next great eruption of 1660 have been given us by two eyewitnesses, the Jesuit father Supo, a mathematician, and Francesco Perotta, a doctor of medicine at Torre del Greco. The first has written two pamphlets entitled respectively: « Giornale dell'incendio del Vesuvio all'anno MDCLX, con le osservazioni matematiche. » « Continuazione dei successi del prossimo incendio del Vesuvio con gli effetti delle ceneri e pietre da quello vomitate, o con la dichiarazione ed espressione delle croci maravigliose apparse in varii luoghi dopo l'incendio. Published in Naples by Gio. Francesco Paci 1661. Both works are now very rare and were, unfortunately, published anonymously. But F. Perotta, who has left us an account in manuscript of this eruption, tells us not only that the two above mentioned pamph-

lets were writtem by Supo, but even went to the trouble of copying and adding them to his own work, thus uniting them in one. This important M. S. exists in library of the Observatory.

This great eruption began in the year 1660, and seems to have continued, with few interruptions, up to 1682. We must conclude so, at least, from the accounts of Ignazio Sorrentino, who happened to be residing, during these years, at his native place Torre del Greco. He, and the before-mentioned Perotta, had the courage to going on there. The roaring and bollowing of the dense smoke, ashes, and flaming projectiles ejected by it, terrified the inhabitants of the neighbouring places to such a degree that they fled. In 1676, 500 people lost their lives at Torre del Greco. In spite, however, of the violence of this outbreak, it was unaccompanied by any flow of lava. This can only be explained by the fact that, after the year 1631, the crater, having become very large and deep, was not yet sufficiently filled with lava to cause it to overflow its brim. The same thing happened in 1872. It took 3 years, from 1875 to 1878 before the crater, formed by the eruption of 1872, became so filled by lava as to let it surmount its edges and flow down the Vesuvian cone.

Only in cases of so-called excentric eruptions, when the side of the mountain burst open, can the lava become visible from below. In our opinion there cannot be an eruption without the emission of lava which, rising and accumulating without the depths of the crater, is, doubtless, the source from which, come the countless pasty and incandescent masses seen gleaming amid the smoke, and falling, still aglow, round the crater. This is all the more evident as almost every writer on Vesuvian eruptions has remarked upon the glowing fire seen amid the smoke, which, however, could only have been the reflection on it from the mass of red hot lava seething inside the crater at no great depth, and mistaken by them for flames

The smoke and ashes during this eruption of 1660 took the form of a gigantic pine-tree with jagged lightnings darting to and fro amid its dense blackness, which rose majestic and terrible, over the summit of the volcano.

P. Supo tells us that the ashes on this occasion were as white as snow. For several hours during the eruption of 1872 the same phenomenon was observed. Microscopic examination showed these white ashes to consist of very fine fragments of leucite. We may conclude then that those of 1660 were of the same nature.

Be that as it may, the year 1682 brought with it a new phase of volcanic activity. With a roaring as of thunder, thick black smoke issued from the summit, interspersed with countless flaming projectiles which, falling on the cone, made it by night seem as if on fire. Lightnings flashed in and out of the smoke which, in the form of a pine, as often before, towered awful and menacing over the mountain. The inhabitants of Torre del Greco, and other places near, fled in terror. It was the month of August, and the grapes were nearly ripe; but, according to Sorrentino, the ashes which fell in the district of Torre del Greco, did them no damage, although they were much injured in more distant parts. The ashes from Vesuvius are always injurious to vegetation, when followed by slight rains. It would require too long a digression to demonstrate the reason why these ashes are hurtful to plant-life.

When the violence of the eruption had abated, several of the inhabitants of Torre went with Sorrentino to visit the crater. They found it greatly diminished in depth, with a hillock or small eruptive cone in the centre.

In October 1685 the activity of the volcano increased. The apex of the cone above-mentioned appeared above the edge of the ancient crater. As in 1682, there were smoke, ashes, projectiles and lightnings in abundance. The grapes were ripe and the harvests gathered in, so that no damage was done by the ashes.

In 1689 there was a great outbreak. Besides the usual phenomena of the three preceding phases just described, the agitation of the ground on the mountain-slopes was terrific. The eruptive cone rose high above the edge of the old crater so that it seemed as if a new mountain was being placed on the top of the old one. The crater was entirely filled with the lava which had been gathering from 1660 to 1689, during which time a series of eruptions had been going on, without it flowing either over the cone or on to the fields below. Not having seen any lava for so long a period the inhabitants of the surrounding districts had almost lost the remembrance of it, and little expected to find it menacing them anew.

In 1694, in the month of March, Vesuvius recommenced activity. Fire and smoke, accompanied by moderate projectiles appeared at the summit. The ground rocked from time to time, the volcanic energy always increasing. A copious stream of lava made its appearance on the 13th April descending in the direction of Salvatore, and precipitating itself on the following morning into

a deep valley called the Fosso dei Corbi, later known as the Fosso Grande, but which is now no longer to be found, being entirely filled up with the lava of 1858. Issuing then from the Fosso dei Corbi it took the direction of the sea towards Pietrabilanca, now Pietrarsa, but stopped at Arso di S. Giorgio a Cremano, somewhat less than a kilometre from the sea.

Cardinal Cantelmo, Archbishop of Naples, mindful of the attempt, not quite without result, made at Catania during the terrible eruption of Etna in 1669, instigated the Viceroy, Count di S. Stefano, to send skilful workmen, in numbers, to try to oppose an embankment of scoriae and earth to the fiery torrent. But, after a day's labour, dissatisfied with the result, they abandoned the enterprise.

The novelty of seeing lava over-running and devastating the country attracted numbers of spectators, for whose benefit booths and temporary refreshment-rooms were put up near the fiery stream, where ices and sherbet were sold, and even disreputable practices carried on. These were, however, put a stop to by the preaching of the Alcanterine friars.

After flowing for a fortnight, the lava ceased. Fire no longer appeared at the summit of Vesuvius, and the eruptive cone seemed covered with the usual various-coloured sublimates among which predominated the yellow, formerly thought by our forefathers to be sulphur, but which we now know to be mostly perchloride of iron. But in the month of July 1696, the eruptive cone which was still existing on the top of the mountain, seemed again as if on fire. On the 4.th August, from the base of that adventitious cone, a fiery stream was seen to issue which, descending to the base of the great cone, circulated in the level part beneath, where, after spreading and accumulating during 10 days, it remained. To this igneous period succeeded that of the ashes, which, as no rain fell, did no harm to the adjacent fields.

After a period of repose, real or apparent, Vesuvius began to make itself heard again. There were tremblings of the ground, and the eruptive cone, rent in various places, sent forth, anew, torrents of fire. These, after reaching the base of the Vesuvian cone, formed into two streams one of which descended into the Fosso dei Corvi, while the other devastated the wooded grounds of the Perroni near the Fosso Bianco, called the Novarra, in the district of Torre del Greco. This flow of lava lasted from the 19th to the 26.th September when it ceased, and the clergy sang a *Te Deum* in thanksgiving.

It does not appear, however, that Vesuvius really suspended its activity until after the great eruption of 1698, the last episode of its history during the seventeenth century. On the 19th May, with terrible noises and heavings of the ground, the most vivid flames blazed from the mountain-top. Lava, in great quantity, flowed rapidly downwards in different directions devastating about 18 acres of cultivated land. The sea at Naples was seen several times to retire from the shore, when the fish became stranded on it and taken.

In the month of June, while this terrible eruption was still going on, the mountain sent up clouds of smoke with the usual accompaniment of lightning, and a great shower of ashes fell. The obscurity was so great that the lamps had to be lit at midday. The greater number of the citizens of Torre del Greco abandoned their dwellings and fled. The Viceroy's commissary, with a handful of soldiers watched night and day over the forsaken houses to protect them from thieves while he himself went to the Ponte della Maddalena in order to give help in money to the fugitives and ordered the inns to be kept open all night for their accommodation.

With the year 1701 a new series of eruptions began which appear to have been as closely connected with each other as if all belonging to one and the same period, until they closed with the great conflagration of 1737.

In 1701, on the first day of the year, a loud explosion was heard from Vesuvius, followed by a great cloud of ashes in globular form, and innumerable projectiles. Then a stream of lava appeared which, dividing, descended in two torrents, one towards Cagnuolo di Ottaiano, and the other to Viuolo. After the lapse of four days, it began to flow more slowly, and the eruption seemed over. But it soon recommenced, the mountain roaring all the time like the sea in a storm, and a great outpouring of lava overran the fields of Ottaiano, devastating not only the lands belonging to the Prince of that name, but also much adjacent property. This conflagration lasted 15 days.

On the 18th. March 1704, a mighty column of smoke appeared, mingled with blazing projectiles. Awful bellowings terrified the neighbouring populations while the ground shook and trembled. On the 20th, a column of liquid fire shot up more than 2 miles in the air with fearful crashes when the rising and falling materials met in their courses. But, by the evening of the 23rd,

all the alarming phenomena had ceased, nor do we hear of the appearance of any fresh lava.

In 1705, especially in January, violent agitations of the ground were felt. On the 20th July 1706, an eruptive phase of some importance exhibited itself which lasted three days.

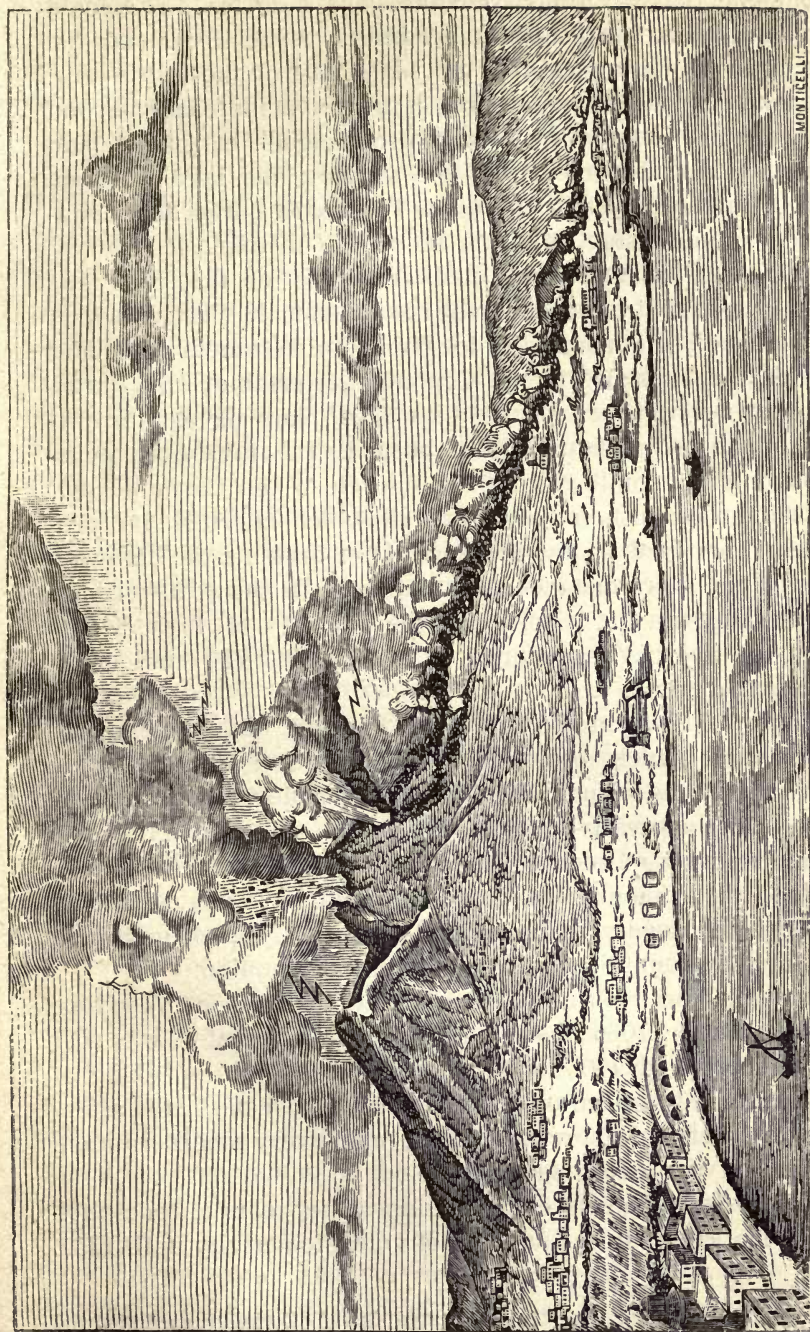
On the 28th July 1707, there was an extraordinary increase of volcanic activity, during which, according to Sorrentino, detonations were heard at Bracciano, 20 miles beyond Rome. The smoke took again the form of a gigantic pine which, interspersed with vivid lightnings and projectiles, rose to an immense height. Stones of great bulk fell to such a distance that the inhabitants of Ottaiano, Bosco and other villages could not walk on the roads. Quantities of sand covered the ground, and tropical rains brought damage to the country round; but this time also no lava was seen,

Ignazio Sorrentino, a close and accurate observer, tells us that after the magnificent conflagration above related, a certain period of repose followed, lasting till 1712. In that year, on the 5th. February, Vesuvius again became active, and a series of eruptive phases took place, going on at intervals from the year 1713 to 1733, accompanied by lava which flowed principally in the direction of Torre del Greco, Bosco and Ottaiano. We need not mention here the usual phenomena, such as rocking of the ground, terrible bellowings, smoke with projectiles, ashes and lapilli, which took place during these years: neither will we describe the customary flights from the villages, nor the prayers and processions of the terrified people. For this we refer the reader to the « *Storia di Vesuvio* », by the above named author.

Sorrentino was the first to note the remarkable appearance of rings or circles of smoke at a certain height above the cone. He relates that on the 11th September 1724, he saw circles of smoke, like gigantic hoops, form about 2000 feet above Vesuvius, and remain unchanged for 8 minutes. This strange phenomenon went on for about an hour, and then ceased completely. On the 11th. June 1733, he saw a circle of ashes about a mile above the summit which, after remaining steady for a while, was finally dispersed by the wind.

The Duca della Torre speaks of the same appearance in 1754, with this difference that the circles were white, and that one lasted 15 minutes unchanged, and another three quarters of an hour.

Taking our stand on the words of the illustrious historian Francesco Serrao in his report to the Academy of Science, we



ERUPTION OF 1737
Plate. 6

must conclude that Vesuvius from the year 1730 to 1737 ejected both fire and smoke with little intermission, especially during the three or four months preceding the 14th. May of the latter year.

On that day the dynamic force of the crater increased beyond measure. Detonations were heard: great clouds of smoke and ashes, with projectiles, rose from the summit; and lava was seen descending in the direction of Bosco. The roaring from the mountain went on increasing, and, on the 19th., an explosion so terrific was heard that the people fled. The side of the cone was rent, and a great stream of lava issued from it, part of which flowed, in the direction of Torre del Greco, while others branched off towards the churches of the Cappucini, Carmine, and Purgatorio in the eastern part of the citx. (see plate 6). All the furnishings of the latter church were burned. The lava even penetrated beyond the small gate of the church of the Carmine and, piling itself up against the convent-wall which checked its progress, nearly entered by the windows. After crossing the highway, it stopped at a short distance from the sea. In the « *Histoire Naturelle des Volcans* » it is told that the quantity of lava ejected by Vesuvius in 1737 amounted to 3 milliards, 750 millions of cubic feet.

The rain, falling on the hot lava, brought out a strong sulphurous stench which withered the herbage all around. Some days afterwards the rain on the burning lava developed another and still more oppressive smell, impossible to define. It is the first time we hear of such a thing. Serrao was the first to call attention to the copious exhalation of carbonic acid gas commonly called mephitic, deadly to both man and beast, which gather at the foot of the mountain during every great eruption.

Francesco Geri took measurements, at this time, of Vesuvius, and found it to be 1066 metres in height. The crater was 177 metres in depth and 700 metres in diameter. Roth, speaking of the ever changing appearance of the Vesuvian cone, calls attention to the fact that it increases in size with every small eruption, but decreases with every great one.

After this tremendous conflagration some years of repose followed. There is no further mention of volcanic activity until 1751.

In the month of April 1717 the celebrated Bishop Berkeley ascended the mountain. He describes its groaning and bellowing as « like a mixture of tempest-rage, sea-murmur and the roar of thunder and artillery all confused together ».

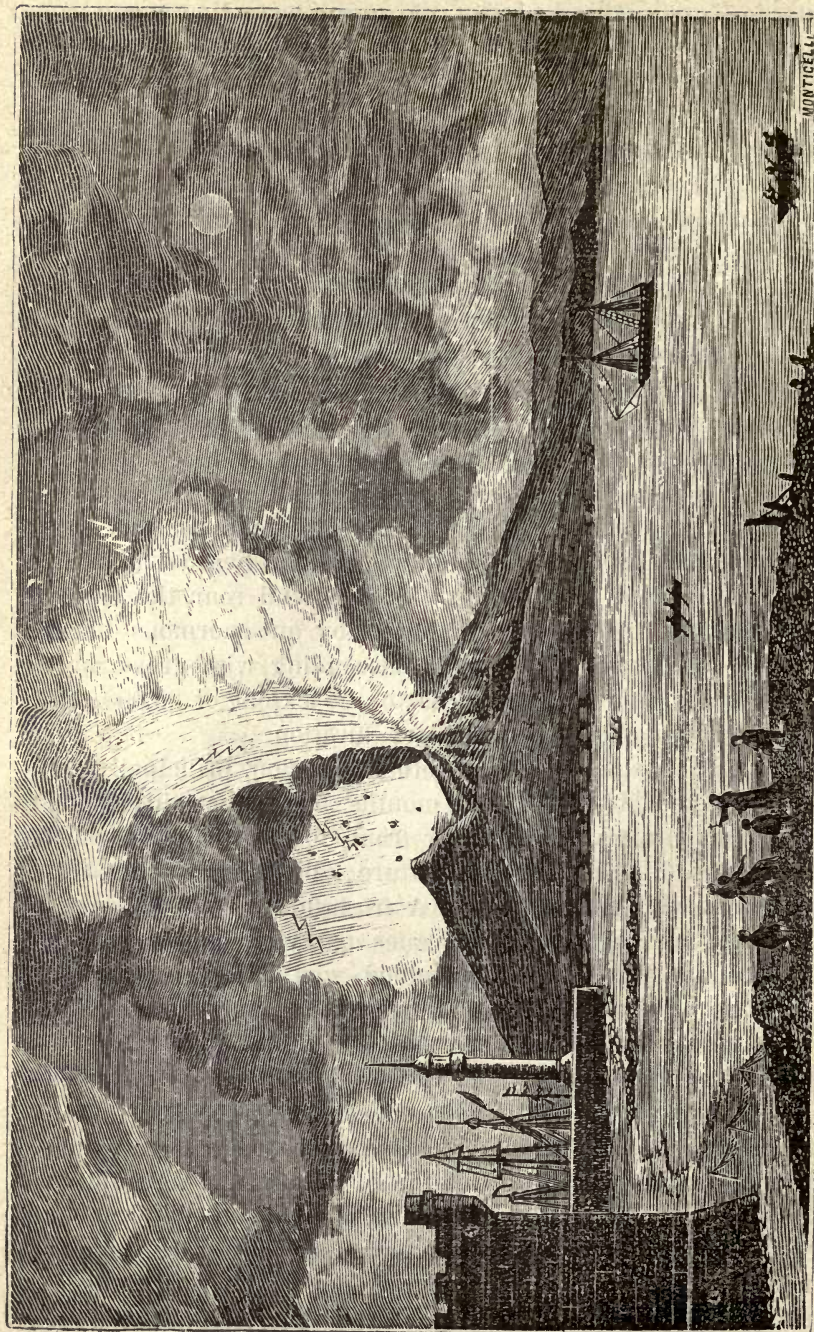
P. Della Torre, who describes the eruption of that year, visited the crater several days before it took place and saw dense smoke rushing out with great violence and hissing. On the 22nd October, from the Ottaiano-side, a rumbling noise was heard followed by an earthquake which shook the ground even at Naples, and lasted until the night of the 25th, when a cleft opened in the Vesuvian cone and a stream of lava gushed out a little above the Atrio del Cavallo spreading rapidly over the fields on the Bosco-side at a speed of about four miles in eight hours. Rivulets of fire poured into various ravines, and were long seen glowing on the mountain-side until they disappeared in February 1752.

There was another eruption on the 2nd December 1754 which, although accompanied by great noise, did no damage to the surrounding villages. A new cone was heaved up to the height of 30 metres.

In the month of March 1759, as Mecatti tells us, fire was seen blazing on Vesuvius. Deep bellowings were heard while the ground rocked to and fro. Finally, with an awful roar, the entire eruptive cone fell in. This was followed by an enormous burst of fire and a torrent of lava which, descending with great rapidity on the fields below, caused loss to the extent of 26,000 ducats. This eruptive phase was of short duration.

On the 23rd December 1760 another eruption, principally eccentric, manifested itself. Several mouths burst open in a line towards the mountain's base not far from Bosco. Eruptive cones were thrown up, like so many miniature volcanoes, ejecting fragments of lava with much smoke. A frightful torrent of fire issued from the base of these new cones carrying devastation to the fields around. The damage sustained was valued at 300,000 ducats. By the 6th January 1761 all was still, and the volcano seems to have reposed once more until the 28th March. 1766.

On that day the rim of the crater was observed to be lower on the Resina-side, and lava was seen running over it. On the 10th April a great cleft appeared in the crater's edge, from which rushed a fiery torrent in the direction of Ottaiano. This eruptive phase lasted on to the middle of December. On the 19th October 1767 terrific bellowings were here heard as far as Naples, making the windows rattle, and the cone burst open at its summit, sending out a flood of lava which branched off into three. The larger part, passing under the hillock where now stands the observatory, flowed down into the Fosso Grande and from thence to the fields below, where it devastated many vineyards, and closed round



MONTICELLI

ERUPTION OF 1779
Plate. 7

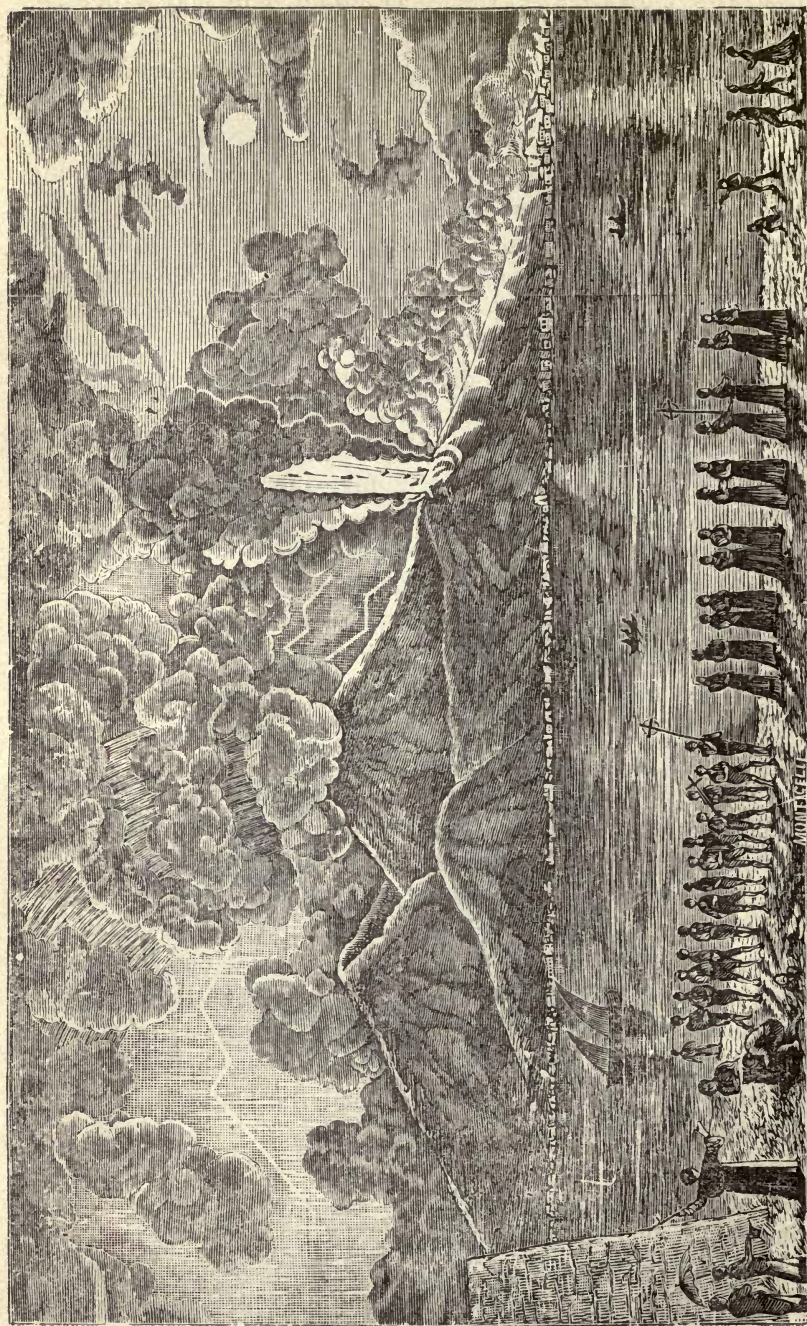
the church of St. Vito which remained intact, and may still be seen on the right of the carriage-road leading to the observatory. Deviating towards St. Giorgio a Cremano the lava seemed as if threatening Naples itself: hence penitential prayers and processions. A certain domenicani friar Rocco by name, who enjoyed an immense reputation with the people, led the excited multitude as far as the Ponte della Maddalena carrying with them an image of St. Januarius, the patron saint of the city. At this point the lava stopped and, to commemorate the event, a marble statue of the saint with his hand raised as in act of command, was erected on it, where it is still to be seen.

According to a calculation of De Bottis, over 1,200,000 cubic metres of lava, and 140,000 cubic metres of ashes were ejected during this eruption. Antonio Pignonata found that the new cone which sprang up in the course of 8 months, measured 185 French feet in height.

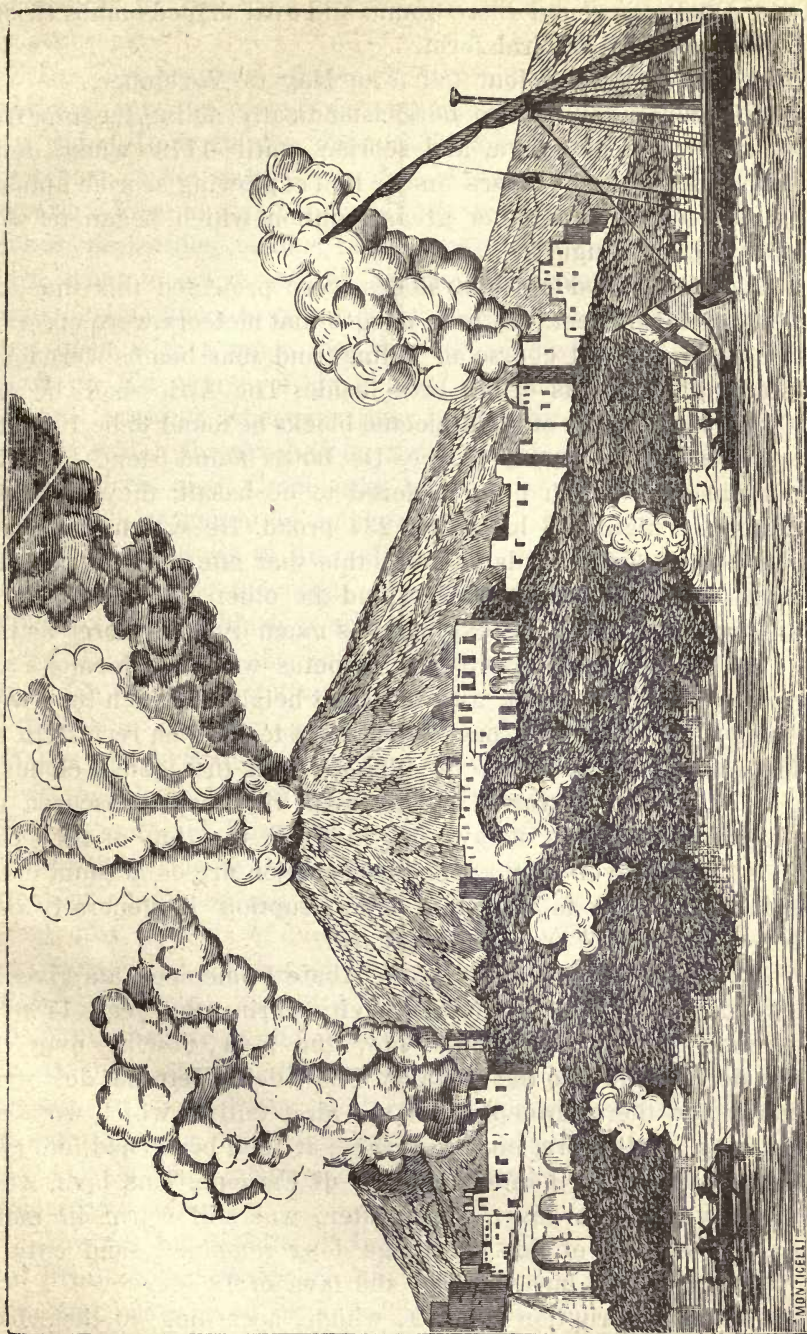
Hamilton relates that he saw a block of stone thrown out, 12 feet in height and 45 in circumference, which fell at a distance of a quarter of a mile from the crater. Stones, glowing and transparent, of about a ton's weight, were projected into the air at least 200 feet high. This rain of glowing stones was the most magnificent spectacle ever seen, far exceeding the most splendid display of fireworks.

The stream of lava was in parts only 10 feet broad, but in others $2\frac{1}{2}$ kilometres, and was 5 kilometres long. It was of a consistence so tough that large stones thrown into it by him remained on the surface and so floated downwards with the fiery stream. During the latter days of the eruption there was a fall of white ashes. Wherever they fell the herbage was destroyed and nothing grew on these fields for two years, although the fertility of the soil was afterwards greatly increased. He also tells us that a peasant living at the foot of Vesuvius had 8 pigs in a sty. The ashes fell among their food, and the animals, on eating it, became giddy and died in a few hours.

On the 1st May 1771, a wide cleft opened, with a roar, on the north side of the Vesuvian cone, about 200 metres below its summit. From this issued lava which, in a few days, grew into an impetuous torrent of fire, doing great damage. A new eruptive cone was formed on the top of the mountain, which at once became active. Other eruptive cones formed upon it, throwing into the air thin jets of lava and red hot stones, which fell on the



ERUPTION OF 1794
Plate 8.



TORRE DEL GRECO OVERWHELMED BY LAVA 1794
Plate 9.

MONTECELLI

Atrio. De Bottis found there round and oval shaped bombs twisted at the ends into a spiral form.

Ashes of a red colour fell from May to November.

Vesuvius continued to be spasmodically active, ejecting from time to time stones, lava, and scoriae, until 1779 when dense smoke, subterranean noises and a hail of glowing scoriae announced the vicinity of another great eruption which began in July and lasted till August.

Hamilton considers that stones were projected this time to a height of 11,000 feet. He tells us also that meteors were observed taking a horizontal course in falling, and that bombs were found containing fragments of old lava inside. The Atrio had become 950 feet higher. One of the projected blocks he found to be 19 feet in height and 66 in circumference. De Bottis found stones on the mountain side, which he considered to be basalt; they were 440 centimetres high, 338 long, and 234 broad. He weighed a small piece of one, and calculated from this that one block was of the weight of 1000 hundred-weight, and the other 1600 ditto.

Few eruptions have exhibited as much dynamic force as that of 1779. It seems, what with the impetus with which smoke and stones were belched out, and the great height to which they were projected, to have been one of the most terrible on record. In the « *Miscellaneae Vesuviane* » p. 122, we read that dense clouds of smoke and ashes, furrowed by incessant lightnings, obscured the light of day. Streams of lava flowed from the top of the cone, and, at night, even Mount Somma seemed on fire on account of the blazing projectiles falling on it. This eruption is generally considered as the 30th from the year 79.

A small and rare work by the Abate Domenico Tata gives us particulars as to the volcano's activity during the years 1786-87. He relates, as an eyewitness, how the lava, flowing over the Atrio del Cavallo into the so-called Fosso della Vetrana, destroyed a hermitage there, sweeping off the altar entire, which was seen swimming, as it were, on the surface; it then branched into two, united again and fell into the Fosso di Faraone. This lava, when visited by Breislak seven years after, was still warm in many places. The ruins of this hermitage long remained, and only finally disappeared, buried under the lava of 1855.

The great eruption of 1790, which, according to the Abate Tata, began in May, but according to the Duca della Torre, in September, ended in October. It was remarkable for the quantity of lava, which issued not only from the crater itself but from

the fissures at the base of the cone caused by the violence of the outbreak.

The last eruption of the 18th century took place in the year 1794, and may be called paroxysmal as having had no precursory signs. It is chiefly memorable for having overwhelmed a great part of the unfortunate city of Torre del Greco. In this conflagration Vesuvius put forth all its powers. Detonations, earthquakes, projectiles, smoke, lava, ashes, lightnings, everything, in short, went to constitute the tremendous spectacle of what hell might be imagined to be. A little above the town several mouths burst open with a noise like thunder, sending out torrents of fire which, in the course of six hours, overran the streets, devastating and burning wherever they passed, until they reached the sea into which they rushed for a considerable distance. The tower of the church of S. Croce may be seen at the present day buried to half its height in solid lava.

Colletta tells us in his «History of the Kingdom of Naples» that this time also the relics and image of St. Januarius, accompanied by the Archbishop and his clergy, were carried in solemn procession as far as the Ponte della Maddalena, but without the hoped for result. He tells also that the lava, in some places, was 11 metres in diameter and 450 metres broad, and ran 24 metres into the sea, projecting 6 metres above the surface of the water.

33 people and 4700 head of cattle perished. The ashes lay for 6 miles round Vesuvius, in some parts two metres deep.

Breislak relates that lava was ejected at this time to the extent of about 685 million cubic feet, and damage done to the extent of 4 millions of ducats. It is mentioned in the «Miscellanae Vesuviane» that the horror of the situation in Naples was increased by the escape, on the 17th June, of the galley slaves, about 400 in number, from the prison at the Capuan gate. It was feared that, in the confusion, they would manage to set free the other prisoners in the different gaols and make themselves masters of the city. Nothing of all this happened however, and, in a short time, most of the unhappy convicts were retaken and again incarcerated.

Towards the middle of July the eruption was over. On the 12th Breislak and Wispeare had the courage to ascend the volcano, and have given us a description of what they saw there. The cone was 220 metres high. The substance of which it was formed was a kind of mortar composed of ashes, lapilli and water, so hard that the guides had to hew steps in it. The upper part

was of ashes alone. The crater was eccentric elliptic, 150 metres in depth and 2150 in circumference. It was highest in the north and lowest towards the south. Its rim was uneven, now higher, now lower. It was oblong, not round, inside, and the walls were encrusted with lava and scoriae,

The Abate Tata, who went up on the 10th August, tells of a very interesting discovery made by him. He found two great blocks of lava 2 $\frac{1}{2}$ metres high, and 9 in circumference, so smoothly rounded that he calls them Ciottoloni, or boulders such as one finds by the sea-shore or in torrent-beds. The substance was as fine as basalt. We may suppose that these gigantic boulders, each of which must have been of a ton's weight, on breaking off from the parent-block, came into a whirlpool and were tossed about for centuries in the seething waters until worn smooth, when, arriving at the bottom of the great eruptive cone, they were shot into the air by the explosive force of the eruption.

Plate 8 shews us the awe-inspiring spectacle with the moon at the full. It has been remarked at the Observatory, that the greatest increase of volcanic activity takes place at the time either of the new or of the full moon. No drawing has been found among the numerous collection preserved in its library, exhibiting an eruption with either a waxing or waning moon.

In the year 1804 the water suddenly disappeared from the wells of Resina and Torre del Greco; the sea retreated and earthquake-shocks were felt, especially at Resina. On the night of the 10th August hollow rumblings were heard. Dense black smoke rushed up from the crater, a mouth opened on the west side of the same, and, shortly after, on the east side also, from which lava poured, part of which took the direction of Camaldoli near Torre del Greco. This continued until the beginning of September. This eruption went through several phases until, in August 1805, a new flood of lava overran the eastern part of Torre del Greco entering the sea by way of the villa Salerno.

On the 27th March 1809, between 9 $\frac{1}{2}$ – 11 A. M. a great rain of ashes fell at Catanzaro and Reggio. As Etna was tranquil at the time, it was attributed to Vesuvius.

Roth mentions that, in December 1819, the lava was of an almost white-heat. Putting into it a piece of copper-wire of the thickness of half a millimetre, and silver wire of the thickness of one, they were instantly fused. Its flow was so rapid, and consistency such, that a long iron pole could scarcely be thrust into it.

On the 6th January 1820 the lava came from an opening 300 feet lower down. At the old opening, the cooled lava was found to be covered with salt of a deep red colour.

During these years lava burst forth repeatedly from new openings at the base of the cone. It was into such a mouth that a Frenchman, called Louis Coutrel, threw himself in a fit of melancholy madness on the 10th January 1821. It is said that, as he leaped into the glowing lava, he called out: « He who dies here will be reborn in his native land ». (This is a superstitious belief shared by many of the Neapolitans). This opening was called by the guides, after that occurrence, « Bocca del Francese ». It existed up to 1872, when it disappeared during the upheavals of that great eruption.

In October 1822 great signs of activity again appeared. There were detonations and bellowsings; the blazing projectiles shooting up day and night from the crater; the gigantic pine tree, furrowed by lightnings, towering in a mighty cloud over the mountain by day, and gleaming red with fire by night; the glowing lava flowing down the mountain's sides in various directions; all offered a spectacle scarcely to be surpassed for awful sublimity.

According to Mauro, on the 21st October there were no flames from the great crater which ejected, instead, ashes and boiling water. This latter flooded the woods belonging to Prince Ottaiano, completely destroying them. During each of these phases fire burst out with renewed force from 4 new fumarole with crateral openings. On the 22nd October a great wind arose which carried the ashes not only as far as Terra di Craco in the Basilicata, but even to the farthest borders of Calabria, where the trees were found thickly strewn with them. During this eruption many tons' weight of common salt fell in a vineyard at the foot of Vesuvius. Numbers of people hurried thither to gather for themselves a good provision of this very necessary article, and the price of salt fell for a time in consequence.

On some days the smoke-pine-tree rose to the height of 2000 metres and extended over several kilometres.

On the 23rd October, according to Roth, about 1 o' clock A. M., a fiery column consisting of sand and glowing masses, shot up 2000 metres high. The eastern rim of the crater burst open, shortly after, with a frightful explosion. Clouds of ashes and lapilli issued from the rent and fell, during $\frac{3}{4}$ of an hour, over Ottaiano and Boscotrecase. Heavy rains fell which, mixing with the ashes, formed thin tufa beds. Great masses of lava were projected to

considerable distances. One mass, many tons in weight, was found in a garden belonging to Prince Ottaiano, about 3 miles distance from Vesuvius.

After the mountain had become somewhat tranquil, numbers ascended it. Its aspect was found to be greatly changed. The Vesuvian cone had disappeared and, according to Mr. Babbage, a huge deep crater 3 miles in circumference and 938 feet in depth below the highest part of its edge, occupied its place. This edge, from being higher than Mount Somma, was now from 300 to 400 feet below its summit. The crater was partially filled with watery vapour mixed with hydrosulphuric and hydrochloric acids. Dr. Daubeney, who visited it in 1824, gives an almost similar description, only adding that some faintly smoking fumarole had formed on its summit.

In the year 1828 a small eruptive cone had formed on the floor of this crater. Signs of activity began to show themselves anew. The crater slowly filled with lava, which, in 1834, had risen so high as to overflow its edge and become visible outside, branching off principally towards Ottaiano.

Abich tells us that he observed, on this occasion, flames of hydrogen. In any case we know for certain that the fish and oysters perished in the lakes of Fusaro and Licola in the Phlegraean fields. After this we have only occasional notices of fire, ashes and lava of small consequence.

In 1839 there was an eruption of no great importance, which only lasted a few days.

Concerning the period between 1839-50, we give the following extract from the account of Professor Arcangelo Scacchi:

« When this eruption, which only lasted a few days, was over, our volcano was tranquil for about 3 years, during which period only a few fumarole and an occasional small fissure appearing at its summit, shewed that its internal fires were not quite extinct. The crater was funnel-shaped. With some discomfort, it is true, but no great danger, it was possible to descend to its depths. In 1841, with a moderate explosion, the bottom opened, and fire burst forth, which, slowly but uninterruptedly, threw up a small internal cone formed of fragments of former lava. Meanwhile from its base, now in one part, now in another, spouted out small jets of lava which, unable to proceed on account of the obstacle of the crater-walls, expanded and accumulated round the new cone which, meanwhile, continued slowly rising. This state of activity, now more, now less, lasted up to February 1845, at which period



ERUPTION OF 1850 — Vesuvius as seen from the Atrio del Cavallo.
Plate 10.

the internal cone had risen to such a height, that it surmounted the edge of the crater, and was visible from Naples; and its eruptions, hitherto only observed from the top of the mountain, could now be seen from a distance. »

We learn further that Vesuvius was only moderately active during the year 1847-48, and became comparatively tranquil in 1849. But in 1850 the new cone fell in with a terrible explosion, and the wells in Torre del Greco and Resina went dry. The restlessness of the mountain increased frightfully until, on the 5th February, the great Vesuvian cone burst open on the north side in such a manner, that the enormous fissure was visible from its summit to its base. Several adventitious cones formed on the Atrio del Cavallo, from the base of which issued torrents of fire devastating the eastern part of the Atrio, and the fields below, as far as Ottaiano. On the 10th February a great quantity of sand was thrown out, and on the 12th the eruption was over.

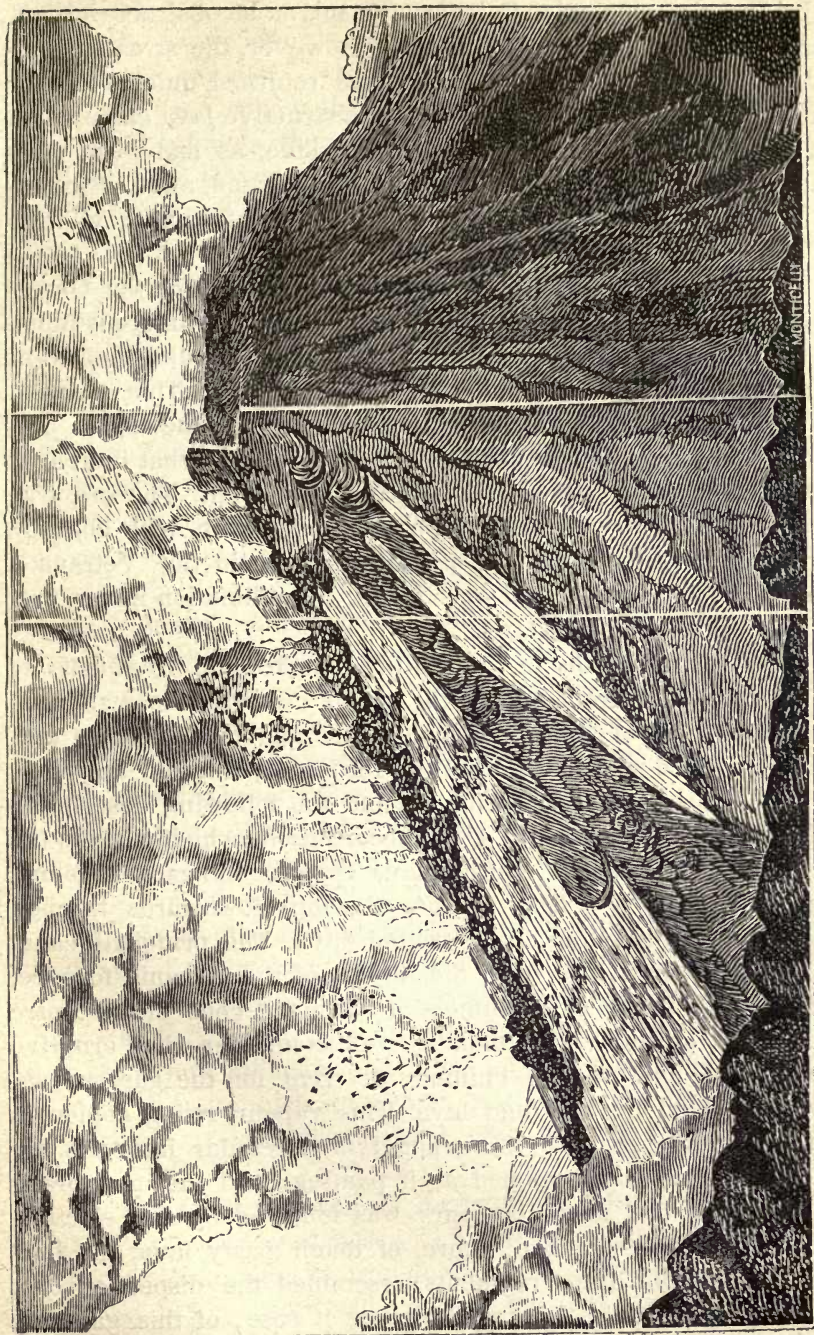
Great changes were found to have taken place on Vesuvius, when its ascent had once more become possible. Instead of the former flat summit there were now two spacious and deep craters with 8 openings on the eastern side, from all of which lava was constantly flowing. The descent into these craters was very dangerous on account of the steepness of their sides. The unfortunate Delius was killed there by a fall to the bottom.

From 1852 onwards the fumarole continued working until the smoke and heat increased. It was then that a deposit of boracic acid was first observed on Vesuvius.

In December 1854 an abyss was formed by the sinking in of the ground on the north-east side, when some smoke was seen to rise.

In May a fissure took place on the north side of the crater from which lava and projectiles were thrown out. Then, one after the other, a line of mouths opened rapidly all along the great cleft as far as the Atrio, from which lava flowed copiously. This burning river precipitated itself over the rocks, like a cascade of fire, into the Fosso della Vetrana covering every thing there with its scoriae, then plunged, as a second cascade, into the Fosso di Faraone, continuing its way to Massa and St. Sebastiano, a splendid and imposing spectacle, especially by night.

The villages above-mentioned are situated on the two banks of the Fosso di Faraone and, as, during the rainy season, great quantities of water rush down that ravine, are united by a bridge. The inhabitants of these two places seeing the lava approaching



LINE OF ERUPTIVE CONES DESCENDING TOWARDS THE ATRIO, 1885

Plate 11.

the bridge, but fearing that its course might be obstructed by it, determined to break it down. Seeing, however, the stream apparently diminishing they let it stand, and returned quietly to their homes. About midnight, however, the destructive lava came down with renewed impetus. Arrived at the bridge, as had been foreseen, it heaped itself up against the obstacle and, after surmounting it, divided, taking the direction of the unfortunate villages and spreading destruction wherever it passed.

Plate 11 shews us the conflagration as seen from the Observatory. The lava continued flowing for 27 days. Numerous fumarole appeared on its surface, after it had stopped, and then went out again gradually in the course of the summer. This eruption is noticeable not only because it began without the usual precursory signs, but also because, except for a somewhat increased activity, the upper crater did not participate in it. The eruptive cones of the Atrio were quite tapestried, as it were, with chloride of iron. Among the deposits of the fumarole in the Vetrana a quantity of chloride of lead was found, a sublimation never previously observed in the lava.

After some months of tranquillity, smoke and fragments of lava were ejected from one of the upper craters. The wall dividing the two great craters disappeared, and the immense gulf became so filled with lava, that in 1857 it overflowed the cone.

In a short treatise by Abich we find the following description of Vesuvius on the 6th July 1857, according to which, outside the crater and under its rim, various lava-canal openings were found, from which issued a fiery stream flowing downwards through the deep ruts formed in the scoriated lava. The principal canal by which the lava rose from the depths of the volcanic furnace, seemed to be in direct communication with the cone in the centre of the great crater, whilst that, as well as another small eruptive cone, served as a sort of chimney or vent for the gaseous vapours generated by the fluid lava. This vapour rising copiously from the great cone, was interrupted, at irregular intervals, by explosions. The abyss seemed as if panting, and the temporary weakening of the dense vapours was followed by the ejection, with greater violence than before, of tough pasty lava, the bursting up of which into fragments resembled the dispersion of a gigantic soap-bubble. The working, as it rose, of this gaseous, faintly gleaming substance, was plainly to be seen.

After observing it for several hours Abich came to the conclusion that this inflammable gas, in working its way upwards,

forced the lava up along with it. The faint gleam of the ascending lava reminded him most of the burning of pure, or half consumed hydrogen.

After each one of these explosions, occurring at intervals of from 8-10 minutes, dense clouds of steam issued from the cone, and the lava moved more slowly for the time being.

This agrees with what Palmieri says in his report to the Academy of Science, namely that, in the middle of July, he had observed burning gas, and that the appearance of sublimated sulphur on the sides of the cracks in the hot ashes had brought him to the conclusion that Vesuvius had entered upon a phase of sulphur-formation.

In May 1858 two new fissures were seen, one at the Atrio del Cavallo, the other towards the Piano delle Ginestre. Palmieri, who was present on the occasion, describes it thus.

First he saw a line of fumarole rapidly formed, and then, the mass of scoriae dividing, he perceived lava moving on slowly and darting up slight jets from time to time like oatmeal porridge or thick starch in the act of boiling. In a few hours the scene changed, and the narrow stream of lava had become a river of fire several kilometres long. Towards the middle of the same day violent bellowsings were heard from the upper crater as well as from the different mouths of the Atrio. Lava burst from three openings with great impetus.

Quantities of incandescent masses were shot up to a height which, in falling one above another, formed 3 new eruptive cones in less than 20 minutes.

These mouths ceased working after a few days, but the lava continued to flow over the Piano delle Ginestre, overwhelmed in its course the newly begun carriage-road, and carried destruction right and left to all the cultivated ground in the vicinity. It heaped itself into hillocks, and filled up the entire Fosso Grande in a short time, to such an extent that, although 100 metres deep, it has now almost disappeared. This flow of lava lasted up to March 1860.

A writer in the Annual Register for 1858 thus describes the lava-streams and cascades: — « Vesuvius is girded with fire, and from this girdle seem to drop down jewels of the utmost brilliancy.»

The upper crater still continued active, yet not to such an extent as to cause anxiety to the inhabitants of the surrounding districts. Francesco di Ambrogio, at that period a judge at Torre del Greco, relates that on the 8th December 1861, about 2 p.m.,

the ground, without any warning, began rocking violently, the most terrific bellowings were heard by the horrified people, coming up, as it were, from the bowels of the earth, This dreadful state of things continued for half an hour, when all became quiet again. But at 3 o'clock this calm was interrupted, when 5 mouths opened simultaneously in a new crater, and an eruption commenced with the usual accompaniments of smoke, lightnings, ashes and showers of stones.

A little above Torre del Greco a new fissure burst open with numerous fumarole. It stretched over the entire town, running into the sea to the extent of a kilometre, as could be observed from the air-bubbles on the surface caused by the escape of carbonic acid gas. Beulé relates that all the fish in that part of the sea perished. On the 9th December the coast of Torre del Greco was noticed to have risen about 1 metre.

On the 12th December the water rose in the wells, but had an acid taste on account of the quantities of carbonic acid, carbonate of lime, and carbonate of iron contained in it. After being 24 hours in the open air it lost this taste, but a deposit of carbonate of lime and carbonate of iron remained.

The 3 mouths continued for 2 days to eject, with great impetus, smoke, lightnings, and showers of red-hot stones. The upper one had opened by a sinking in of the soil. There was standing a cottage on the spot, in which the owner and his wife were sitting quietly when then they were startled by seeing a cattle-bell, which was hanging on a nail, swaying without any visible cause and ringing violently. Thinking this the work of an evil spirit they rose and fled from the house. Scarcely had they gone 100 yards when, hearing a dreadful noise, they turned to find that their cottage had disappeared, and to see smoke and lava gushing out from the place where it had stood.

Towards evening the well-known pine-tree appeared above the mountain-top.

At Torre del Greco the water rose so high in the wells, that it broke through the aqueduct in several places, and rushed down to the sea like a rivulet. The temperature of some springs near the sea, rose to 38° centig. Several rocks, usually under water, were seen high above it, and Palmieri, in order to assure himself whether what former writers had asserted as to the sinking of the sea during eruptions were correct, took a boat and rowed slowly along the coast. On the perpendicular rocks, formed for the most part from the lava of 1794, he found, to the height of a metre

and a half, a belt of seaweed and shells which could only exist beneath the water.

Rowing on, he convinced himself that this belt was highest below Torre del Greco, gradually becoming lower until it was no longer visible either at Torre Bassano on the one side, or at Granatello on the other. From this observation he concluded that, instead of the sea going back, the soil became elevated. This hypothesis would at the same time account for the falling in, without any apparent earthquake, of all the houses built on the lava of 1794.

There were fissures in the ground in several parts of Torre del Greco, and in some places the temperature rose. There were such powerful exhalations of carbonic acid gas that Palmieri never went through the forsaken streets without a burning lamp in his hand which, by becoming extinguished, might warn him of approaching danger. Besides carbonic acid, sulphuretted hydrogen and liberated hydrogen were observed at this time. Some of these gases had a strong smell of petroleum, and corrupted the water, which retained a nauseous taste long after the usual supply of water returned to the wells.

Even the fish taken up dead on the shore, emitted a pestiferous odour.

The most careful observations were made by Professors Palmieri and Scacchi as to the rising of the sea and resinking of the soil which had been elevated so greatly in the course of less than 24 hours.

They found that, after the lapse of a year, the coast had not sunk to its former level by some decimetres.

Let us, before going further, give a cursory glance at Torre del Greco, which was founded in the 12th century by the Emperor Frederic II. As shewn by the results of excavations, it has risen on the top of former ruins buried and forgotten for more than 1800 years. Not only devastated but destroyed no less than 11 times since 1631, by the fury of its dangerous neighbour, it rises from its ruins and flourishes anew, a striking proof of the invincible attachment of man to his native soil. In spite of the ever threatening danger, he returns to his shattered hearth, and rebuilds it with vigorous hand and fearless brow on the still warm lava. Thus churches rise over temples, streets over streets, houses over houses. The starry vault of Heaven is over his head, the blue sea murmurs ceaselessly by his side, and beneath his feet,

deep in the bowels of the mountain a mysterious fire burns on for ever, threatening destruction to him and his.

Whilst the newly formed eccentric craters above mentioned were slowly cooling, and even the principal crater was gradually becoming tranquil, the activity of the fumarole continued. In February 1865, fire was again seen in the old crater; from its bottom arose a new eruptive cone; and on the 11th March 1867, lava recommenced oozing from its base. As the seismic apparatus exhibited more disquiet than the condition of Vesuvius at the time seemed to justify, Palmieri considered this to be a premonitory sign of an approaching great eruption.

In November 1868 a new fissure opened on the north side of the cone, from which lava flowed in the direction of the Atrio where, in a short time, several new eruptive cones were formed in a line, united, one with the other, by copious streams of the same. This lava, flowing through the Fosso della Vetrana into the Fosso di Faraone, devastated the fertile district of la Nocella. The entire eruption lasted only 8 days. The lava ejected by it furnishes excellent building materials.

In the autumn of 1870 Vesuvius again became disturbed. Smoke and fragments of incandescent lava were ejected, with violent gusts of wind, from a small opening at the bottom of the central crater. But although the activity of the central crater continued, this eruption changed into an eccentric one, as on the north side of the great cone an adventitious one of about 20 metres in height was formed, from which, as Palmieri tells us, lava burst forth with a rapidity never before seen by him. Instead of being of the usual pasty consistency, it was so thin that it went into filament like spun glass. The fragments of the same, found later in great quantities on the mountain, were denominated by Professor Scacchi « lapilli filiformi ».

Traversing the Atrio, the lava reached Crocella in a few days. It was thickly coated with scoriae through which, as through a sieve, it sent up these slender jets. There were not many fumaroles. This coating of scoriae ceased at Crocella where the lava lost itself finally beneath the Cantèroni ridge.

The smaller cone glowed brilliantly every night up to the month of March, but went out when the lava ceased flowing. Palmieri ascended it and found that the walls of the new crater were formed of scoriae like stalactites in shape, and covered with variously coloured sublimations. Before long an opening appeared on the floor of this crater from which small projectiles were

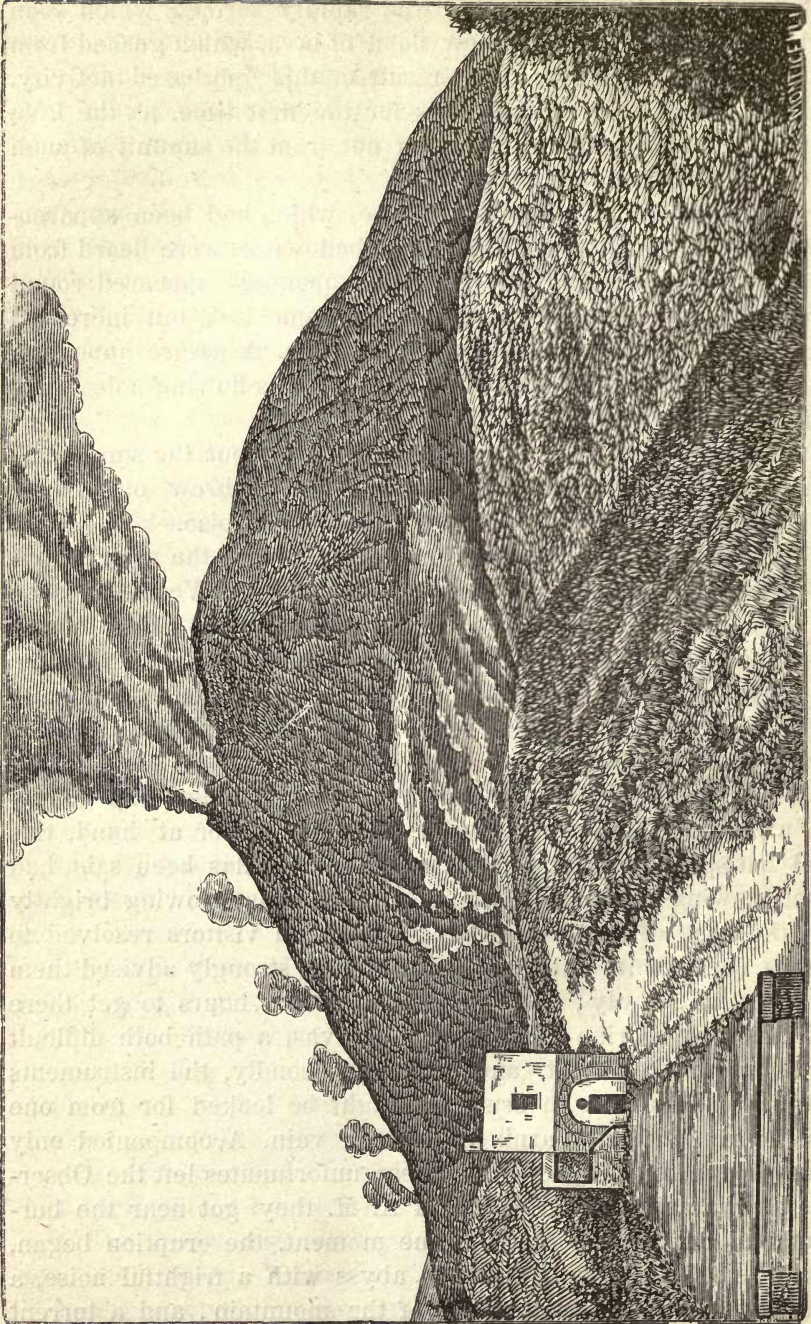
ejected, of which another cone was rapidly formed which soon filled the whole interior. A new flood of lava, which gushed from the top of this cone, was the result of this increased activity. Palmieri affirms that he saw this for the first time, as the lava generally exudes from the base and not from the summit of such ephemeral or adventitious cones.

In December 1871 the small cone, which had been apparently extinct, awoke to new life. Loud bellowings were heard from the principal crater and several small openings appeared round it. In February 1872 the disturbance became less, but increased again in March, near the time of full moon. A fissure appeared, and a line of fumarole shewed where lava was flowing noiselessly from it into the Atrio.

After little over a week the lava ceased, but the small cone became very lively while the central crater threw out smoke and projectiles with a tremendous thundering noise.

On the 23rd April, at the time of full moon, the seismic apparatus became greatly agitated. On the 24th the Vesuvian cone was seen as if furrowed by splendid lava-streams. This magnificent spectacle lasted till morning when the lava ceased flowing, and only exuded slowly from the base of the cone. But, in spite of this apparent tranquillity, the instruments continued to be extraordinarily restless.

On the night of the 25th April, a party of ladies and gentlemen went up Vesuvius in order to enjoy, closer at hand, this awful but splendid sight. The lava-streams, as has been said, had ceased flowing and only a small branch was glowing brightly from the base of the cone. The disappointed visitors resolved to venture close to it. This Professor Palmieri strongly advised them not to do, as, firstly, it would take them two hours to get there over fields of scoriae left by former lavas, a path both difficult and dangerous by night, and because, secondly, the instruments were so restless that an eruption might be looked for from one moment to another. Warnings were in vain. Accompanied only by a very inexperienced guide these unfortunates left the Observatory towards midnight. About 4 A. M. they got near the burning lava, but, almost at the same moment, the eruption began, and the small cone sank into the abyss with a frightful noise, a great fissure opened in the side of the mountain, and a torrent of fire flooded the Atrio del Cavallo, accompanied by blazing projectiles from the upper crater. Many of these unfortunates, enveloped in smoke, struck by projectiles, and overtaken by the



ERUPTION OF 1871 AS SEEN FROM THE OBSERVATORY

lava, disappeared beneath the igneous torrent. Two were taken up dead, and eleven were found severely injured. Most of these died either in the hospital or on the way to it.

In order that the reader may obtain a slight idea of the tremendous force of the lava-floods, it may be as well to give here a short description of the Atrio del Cavallo as it was in the year 1877. It was formerly called Vallobe Grande, and is said to have received its present name from a projecting mass of lava in shape somewhat resembling a horse, but which has long disappeared. This valley is 5 kilometres long and 800 metres broad, and lies, in the form of a semi-circle, between Vesuvius on the one side, and the steep jagged cliffs of Somma on the other. On visiting it for the first time in 1876, we were struck by the awfull grandeur of the sight, a sight surpassing every human imagination. Gigantic rocky pillars met our eyes, towering on high, and divided from each other by scoriated lava-canals which it was impossible to cross. Masses on masses of lava, bare of all vegetation, lay heaped together in all sorts of phantastic shapes, a stony sea over which brooded a stillness as of death only broken, from time to time, by the deep hollow roar, as of thunder, coming up from the depths of the mountain, and echoing heavily through the petrified valley, or by the fall of an occasional stone which, becoming detached from the rocks above, clattered downwards with a sharp ringing sound. Busy fancy conjured up before us the terrible picture of the night of the 26th April 1872, here where so many lives were lost, victims to a thoughtless curiosity. Thinking of the despair, at that awful moment, of those unfortunates whom inconsiderate levity had hurried to destruction, our hearts stood still with involuntary compassion for their horrible fate.

And now let us cast a glance at the Atrio of the present day. Masses on masses of lava heaped over each other in wild confusion still meet the eye; but the ravines are filled up, partly with sand, partly with fresh lavas. Lava has united the great pillars which now form one compact mass, and lava, in countless strata, occupies almost completely the long and broad valley, so that its ravines can no longer form canals for the destructive floods. For this reason we must expect, at no distant date, to find the fiery element encompassing and endangering at last even the watch-tower of science which has hitherto stood so fast.

We return, after this digression, to the eruption of 1872.

The lava, after literally rushing through the Atrio, the Fosso della Vetrana, and the Fosso di Faraone, divided. One branch spread over and dissipated itself in the lava of 1868, while the other, taking a longer course, destroyed several houses in the villages of Massa and St. Sebastian, and overwhelmed, finally, the small village from which the celebrated pianter Luca Giordano, who was born here, took his name. The only house left uninjured was that formerly occupied by Luca himself.

The night of the 26th — 27th April furnished, according to Palmieri's account, one of the grandest spectacles ever beheld. The Observatory was surrounded by two streams of lava, the heat from which was so great that the thermometer stood at 74° centig. Great clouds of smoke, furrowed by lightnings, rose, amid terrific bellowings, from the principal crater, and countless blazing projectiles fell on the terraces of the Observatory. The cone itself seemed literally on fire, not only on account of the flames issuing from it, but also because of the incandescent lava fragments falling incessantly over it, while lava oozed from shurface in a thousand places without flowing down. During all this time the ground never ceased rocking.

While the lava was thus taking its impetuous course, Palmieri observed 3 different eruptions, with the usual jets of stones and smoke, at 3 different points of the igneous torrent. Each of these outbreaks lasted about 20 minutes. These phenomena were observed from Naples, and, when a lofty column of ashes and projectiles shot up near the Observatory, it was thought that not only had the cliffs of Somma been split, but that the Observatory also, where Palmieri and several of his assistants remained, in spite of all entreaty and warning, had been destroyed. These 3 remarkable outbreaks have never been satisfactorily accounted for. Palmieri maintains that they were produced by the lava, and completely independent of the spots where they took place. Dr. A. Heim, on the contrary, asserts that, as the 3 points from which the eruptions came remained steady in the midst of the moving lava, their cause is to be sought, not in the lava but in the motionless ground, where a spring perhaps, or a concealed vein of water might be found.

As we possess an excellent description of this conflagration from the pen of the last named celebrated geologist, we add a short extract from the same, hoping that the reader may thus get a vivid impression of this tremendous spectacle.

... « The wind prevailing in the upper atmospheric strata was from the north, and bent the highest part of the great cloud of smoke towards the south where the ashy mass separated and sank lower like a heavy rain-cloud. There, like a dark thunder-cloud, it remained and we could distinguish, at times, the lines of the falling ashes and rain. Evening came. The groaning mountain seemed small and low beneath the lofty smoke cloud which took the shape of a wonderfully beautiful double pine-tree. The white vapours which rose from the lava spread high over Vesuvius, like a stratum of white cloud. This was pierced in the centre by a dark stream of smoke and steam spouting perpendicularly out of the upper crater. The sun set, and the shadows rose higher on the vapoury column. High above, the mountain's cloudy crown beamed calmly in the most perfect Alpine glow, first orange, then, ever deepening, red against the purpling sky. The last beams of the sun faded in crimson on the summit of the slowly upward-moving pillar of cloud. Below it, however, as the bright sunlight faded, the glow from the interior gleamed in a sort of cold blue shadow. It was first visible on the outer edges of the lava, and the vapours proceeding from the inner glow, took the form of rays of light which gradually developed into a great upright column of fire rising from the upper crater. One could see the lava, burning up everything on its way, as it reached St. Sebastiano and Massa, and approached La Cercola a little before 6 o'clock. One could see the trees blazing, and the buildings surrounded by it, partly falling in while smoke and dust rose up from them in clouds. The roaring and thundering of the mountain, the rocking of the ground with occasional more violent shocks, went on constantly, and the lava-stream glowed red from its summit to its base. As the dense, impenetrable mass of ashes and vapour sank lower on the mountain, the fiery column from the central crater became more indistinct, and the glow was lost in it. Such was Vesuvius throughout the night of the 26th-27th April.

The excitement in Naples was intense. With their goods piled on the queerest vehicles the fugitives from the threatened places might be met hurrying to Naples. Processions went singing through the streets in order to exorcise the cruel mountain. The military were ordered out for the preservation of public security.

Wherever a view of Vesuvius was to be had crowds assembled, and every where the words were heard: « Mai, mai così ».

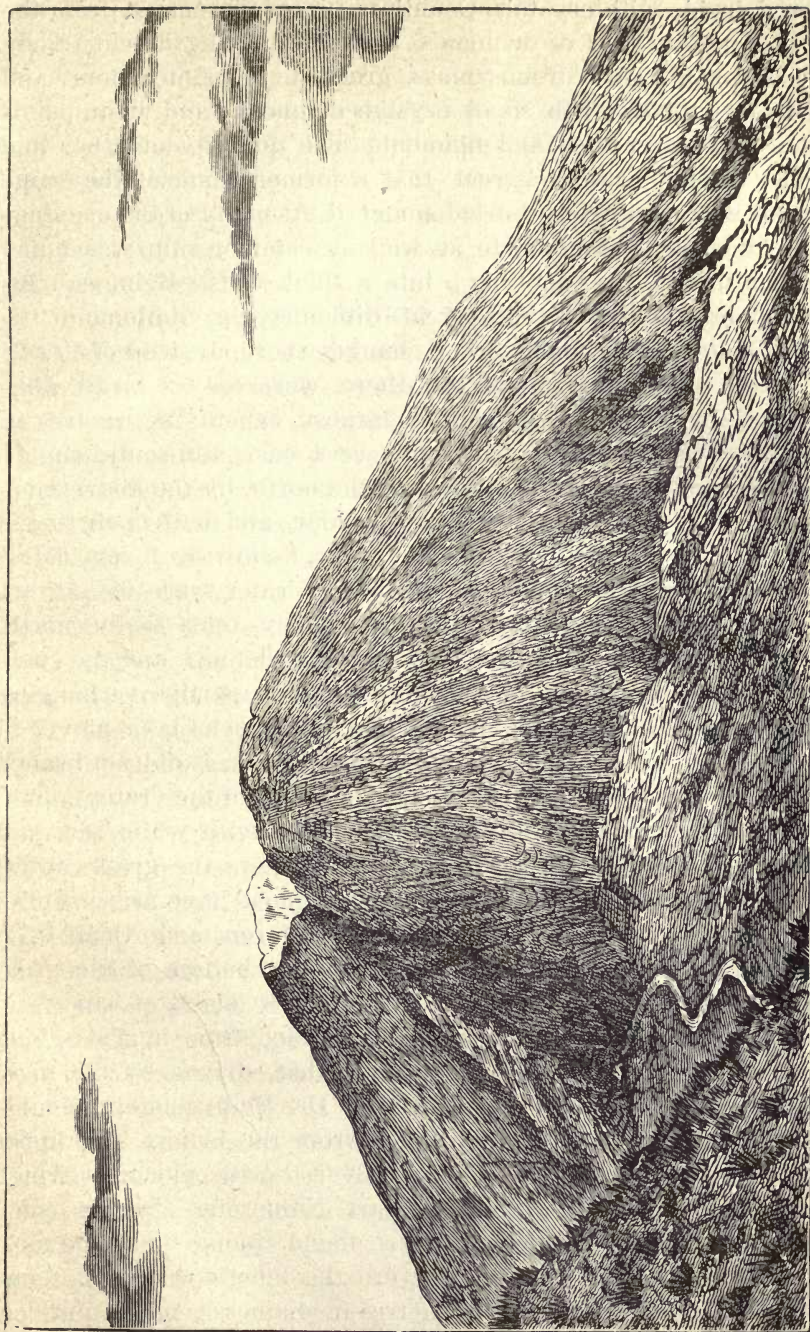
The night passed thus with no great variation. The lavas by St. Sebastiano, Cercola, and St. Giorgio moved slowly on. From

time to time a flash of lightning from the south east, where the great cloud of vapour and ashes, driven by the wind, was hovering, lit up the part of the horizon behind Vesuvius, and shewed its contour for a moment. This had visibly changed.

On the 27th of April we went with Professor Guiscardi to Resina, where we encountered the fugitives in hundreds whit their piled up waggons. Instead of looks of despair, the most general expression seemed to be joy at having escaped with life. Among those left behind in Resina there was no appearance of excitement; they seemed utterly wearied and apathetic. Without any apparent cause the wildest reports were circulated as to what Palmieri had foretold.

They either hung on his words as on those of a god, or knelt in the churches. Here was clearly to be seen how man, in his hours of weakness, is ever inclined to place the reins, with superstitious resignation, in the hands of another being, so as to be no longer responsible to himself for his own actions, and to bow down before any one who is, as he thinks in his terror, in immediate connection with omnipotence. Thus, by the uncertainty of volcanic phenomena, and by the fact that hundreds of lives may depend on the event of a moment, mental equilibrium has, without doubt, in some regions been destroyed. Where they are frequent, imagination flourishes at the cost of understanding, while knowledge alone gives mental power ».

Heim describes his ascent of Vesuvius on the 30th April, and relates that ashes, consisting, as he says, of crumbs of porous lava of the size of peas, were lying 2 centimetres deep on the Observatory. Seen from there, the still smoking volcano seemed to him like a giant exhausted after a terrible putting forth of his strength. The lava, in consequence of hillocks of from 50 — 100 metres in height, had piled itself round them until it became like a sea. These hillocks were formed of mighty blocks of lava massed up together in wild confusion. These blocks, the fractured edges of which were frequently quite fresh, were often more than 3 metres in diameter. One piece which had been blasted from the mountain, dammed up a new fissure like a great rubbish mass. This happened probably on the 26th April, simultaneously with the sad catastrophe before related. The soil of the Atrio had risen 6 metres in consequence of the lava; its surface was broken and jagged. Furrows 3 metres deep, interchanged with rough ragged looking hillocks. Many bombs, mostly half a metre in diameter, were found. These consisted principally of older, and somewhat porous lava, and were thickly



VESUVIUS AFTER THE ERUPTION OF 1872
Plate 13.

covered inside with crystals. Countless pieces of scoriae, from the size of a nut to that of a man's fist, were lying about. They consisted of a dark vitreous mass, greenish black in colour, and full of air-bubbles, with small crystals of leucite, and white points in the vitreous surface and filaments. The quantity of ashes and scoriae ejected was so great that a former cone of the same material was completely buried under it. At many of the openings of the fumarole sal ammoniac as well as common salt, was found re-crystallized, after melting, into a thick crust. Heim and his companions succeeded, with great difficulty, in climbing to the crater's edge. They found great changes there. Instead of 4 craters on the summit, as formerly, there were only 2 large ones separated by a wall of lava. The largest, about 200 metres in diameter, was circular towards the west, east, and south, and divided from the smaller one, towards the north, by the above mentioned wall. The smaller one was circular, and half open to the north, and was separated from the new fissure by a low ridge. This fissure and the central point of the crater were in a direct line with each other. All three were partly open to the north. The ridge of the central crater was sharply defined, and the enormous funnel was circled by frightfully steep, partly overhanging walls. Its depth was about 150 metres. Tongues of lava moved in a vertical direction almost to the crater's brink. It did not branch off and was sharply defined. Along the edge of the crater numerous fumarole covered the rocks and ashes with white, red, and yellow sublimations. Out of the 4 former craters the great central one had now been formed, which latter must have arisen out of the smaller one which was so active in March and April 1872. One could hardly perceive the cleft at the bottom of the great double funnel, on account of a dense black cloud of sand and ashes which, now less, now more, ascended from it. This cloud was so laden with sulphurous vapours that, driven by the high, always shifting wind into the faces of Dr Heim and his companions, it literally forced them back from the brink. The upper part of the mountain was thickly covered with ejecta of which coarse ashes formed the greatest part. Numerous crystals, such as augite, leucite, olivine, etc. were found among them, the most plentiful and beautiful of these were the leucite crystals. Some specimens were from 5-8 millimetres in diameter, many quite colourless, pure and transparent, with sharp edges and brilliant polish. It is singular that while the lava from the base of the Ve-

suvian cone has only very tiny leucite crystals, that from the craters at the summit should throw out such large and fine ones.

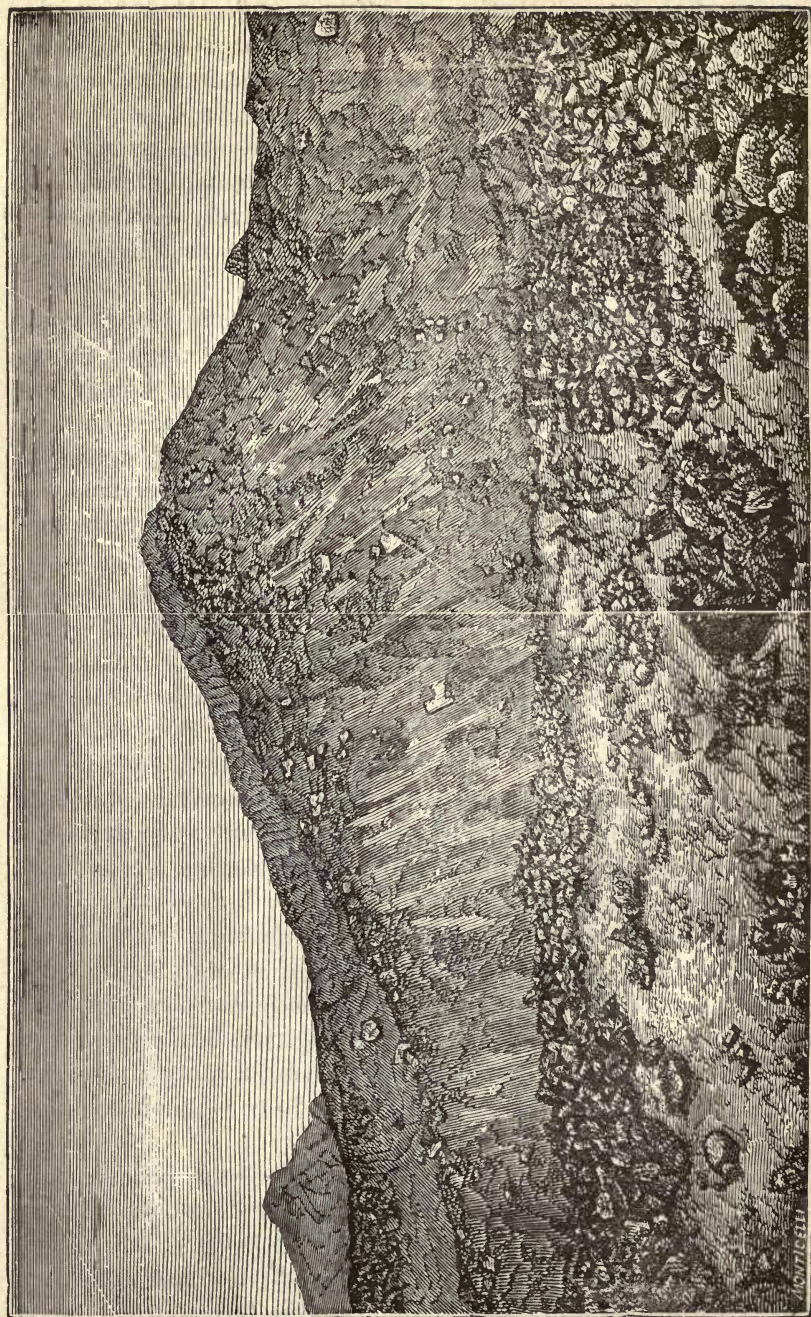
On the 6th. May there was only faint smoke from the crater, and on the 8th. Vesuvius seemed as if fallen asleep.

In the year 1873 Palmieri succeeded in descending into the principal crater. The result of a superficial calculation was that it had a capacity of about 17 million cubic metres, and that, during the eruption of 1872, about 20 million cubic metres of lava had been ejected.

Since the eruption of 1872 there is not much more to tell about Vesuvius and its doings. It remained quite tranquil up to 1875 when the fumarole on the crater's rim, and, after them, those at its bottom, began to smoke once more. From the month of December onwards lava began to ooze up from of the crater until, by slow degrees, it filled the entire basin. In 1878 it reached the edge at a point where there is a sharp depression towards the north east, generally known as « la finestra, or the « window ». At Naples, during the space of three years, the lava could be seen flowing from this spot. In 1882 it ceased for a short time. During this interval the lava in the interior of the crater increased to such an extent that it completely filled the great basin formed in 1872, and flowed over its edge in the direction of Pompeii. This splendid sight lasted 6 years. Such a quantity of lava was ejected that, latterly, the Vesuvian cone has visibly changed in shape. It remains to be mentioned that lava was seen, but only during a short time, on the side of the mountain towards Naples. No damage of any kind resulted from it.

Since the year 1890, a mouth has been formed on the Atrio, just at the place where the sad catastrophe of the 26th. April 1872 took place. It is constantly although moderately active, and has already ejected so much lava that the Atrio has completely lost its former appearance and has risen considerably in height. In all probability it will change still more in consequence of this continued volcanic activity.

In the beginning of June 1891, the top of the cone fell in thus forming an immense crater more than 650 feet deep. On the north side of the mountain a fissure appeared from which issued an abundant flow of lava covering the lava of 1871, and reaching to the « atrio del cavallo » where it formed a hill 400 feet high. This fissure was about 3000 feet above sea-level. After two days the lava ceased flowing from there, but about 2490 feet lower, down other openings appeared, from which lava was emitted in



VESUVIUS AFTER THE ERUPTION OF 1872
Plate 14.

1892 - 1893. On the 3rd February 1894 these fissures closed again and the activity of the volcano was concentrated in the principal crater.

On the 16th February Prof. Matteucci found that the lava had filled the crater to the depth of 120 feet. Throughout the whole year, with only short interruptions, the volcano continued active. At night one could see a glow on the summit of Vesuvius caused by the burning lava falling into the crater. Jets of scoriae were thrown up which, not being high, and rather ample, looked, to the unpractised eye, like flowing lava. Often too, explosions were heard, though of no great violence, and there was a small flow of lava at the bottom of the crater, which would only be seen by those standing at its brink. In June 1895 it was evident that another eruption would take place.

From January on, the activity of the volcano became more pronounced. Explosions could be heard from a distance, followed by jets of compact scoriae, which went up as high as 300 feet, sometimes even more. In the month of February, the small cone which had been forming in the crater of 1891, began to be visible and little by little, from being 45 feet on the 7th May, it had grown to be 75 feet on the 15th of June. During May the explosions became more violent and frequent, and the jets of burning scoriae were almost continual.

In the beginning of June the Strombolian activity of Vesuvius was rather strong. The small cone, after having crumbled down, had grown again, and changed its shape, and, at the end of the month, measured 150 feet from the western edge of the crater of 1872. The lava had risen to such a height, that it could go no further, otherwise the sides of the mountain would have given way, as the pressure would have been too great for them to resist. — On the 3rd July at 18 minutes past 10 a. m. the summit of the cone fell in, forming again a vast crater, and a fissure was formed on the same level as the funicular rail way from which a small current of lava flowed towards the « Atrio del Cavallo ». At 10,30 another fissure opened 200 feet lower down, emitting a still larger quantity of lava, and at 2,15 p. m. a third opening 600 feet lower still, appeared, the lava issuing from which joined that from the second fissure. On the 5th other fissures opened at 2250 above sea-level. — On the 4th the central crater began to throw out columns of vapour, ashes, and projectiles of old lava. Ashes in small quantities fell also at Naples. — The lava which issued from these openings divided into

two branches one taking the direction of Vetrana, the other passing between Crocella and the fissures of 1858, thus, meeting the main-road, which leads to Cooks Funicular Station (the lower one) covering it with lava for about 1200 feet.

On the 6th, this current divided into two arms, the one running in the direction of the southern basis of the Canteroni hill by the vallone di Scariglio, and the others to the Piano delle Ginestre. The other branch which had gone towards Vetrana, was nearly extinguished. Meanwhile the fissures of the 5th continued to send forth abundant quantities of lava. The « Piano delle Ginestre » was covered, and the principal branch which was directed towards the Crocella, approached to the distance of about 300 feet from the Observatory, thus placing it in great danger. There it had the appearance as if the lava were issuing from a new fissure, but that was only because the new lava was running beneath a kind of tunnel, formed by the old lava. This lava, on the night of the 13th August, invaded the main-road, which on the 17th December of the same year, was invaded by another lava current. Crocella was quite destroyed. The lava descended to near the Observatory, and from thence into the trench of Vetrana, filling it almost completely. In December this eruptive phase began to calm down, and during 1896 Vesuvius showed changes in its activity, but less than during the months of June — December 1895. Lava continued to be emitted from the fissures of the 5th July, but stopped by the side of the « Piano delle Ginestre ».

In the Vetrana the emissions continued at intervals, and in the month of April, at the summit of the lava-hill which was, being formed at the back of the Observatory, other pseudo fissures appeared, from which occasionally lava continued to flow sometimes into the Vetrana and sometimes again on to the « Piano delle Ginestre ». During the month of August three separate currents could be seen from Naples, one flowing to the Vetrana, another to the foot of Mount Somma, and the third to the « Piano delle Ginestre ».

In December one arm of the lava from Crocella, crossed Cook's main-road twice, and reached the Piano delle Ginestre.

The quantity of lava given out during that year was enormous, although the activity of the crater was small. The formation of the lava-hill which rose to the height of 195 feet had taken place.

The 1897 the emission of lava continued. Cook's main-road, which leads to the lower Funicular Station, was covered in se-

veral places, and at different times, (2nd February 21st and 26th May 3rd and 4th June) by the currents of lava which came from the Crocella and Atrio del Cavallo. On the 23rd April, an abundant quantity of lava descended into the Vetrana and reached the foot of Monte Somma, and also during May, July and October till December, other currents descended into the Vetrana, Piano delle Ginestre and Somma. The lava-hill continued growing. The dynamic force of the volcano had periods, when it increased but it was always slightly perceptible, and there were jets of scoriae lapilli and ashes, which fell at the foot of the cone.

In the year 1898 the emission of lava from the various fissures, and more especially from the lava-hill, were most abundant, but the dynamic force of the crater was only slight. On the 6th January the lava covered the funicular railway in two different places. On the 11th and 23rd the lava got under the road, and dividing into three branches, descended toward the Piano delle Ginestre. On the 19th, 20th and 21st the direction of the lava was towards the Atrio del Cavallo, and on the 28th towards Somma. The activity of the crater was slight, it only gave out a few explosions of burning scoriae and ashes.

During the first days of February the flow of lava began to diminish, but on the 5th and 9th it approached the back of the Observatory. On the 7th a stream of lava from the lava-hill crossed Cook's main-road and on the 16th and 19th other pseudo fissures opened from which on the 17th such a quantity of lava issued that it reached the foot of mount Somma.

About the middle of March there was a great increase in the lavas, which were in the Atrio and Vetrana.

A small current ran towards Cook's main-road but stopped at about 420 feet from it. With the increase of lava also the activity of the crater increased, which showed itself through Strombolian explosions which on the 13th reached a great intensity. In the following days they began to diminish, recommencing in the month of April and May with lofty Columns of smoke and jets of ashes and stones. In the night of the 9th 10th May the summit crumbled down, and for a few days, the eruption seemed over. But by the end of the month it recommenced, while from the side fissures of the base of the great cone the lava current was not very liquid.

In the central opening the lava, which was flowing in a very liquid state from two openings in the crater, rose during the month of June to a height of 450 feet.

In the mean time from the lava-hill, which having been always covered by new lava had risen to a considerable height. on the night of the 30th two currents of lava came down, one in the direction of the Atrio and the other to Vetrana. From July to September the emission of Lava was very abundant, and the lava was mostly coming from the new lava-hill. It ran in different currents, some going to the Atrio, then to Vetrana and even to Somma putting Cook's main-road several times in danger; twice during the month of September the road was damaged. From the 13th the 17th September there were great explosions in the central crater and at the same time the emission of lava from the side fissures increased. From October to December the activity of the crater was very moderate, excepting during the last days of the year, when several lava streams were seen, which ran in various directions, but mostly covering the other lava which was still warm. The currents of lava too were decreasing and only once on the 12th of November a lava stream damaged Cook's main-road. The new lava-hill had at the end of 1898 risen to 2595 feet above sea-level or to 345 feet from the ground.

In 1899 the eruptive period which had began on the 3rd July 1896 ended, but the emission of lava continued till September with various interruptions, when at last it came to an end, having lasted four years and two months. The fissure of the 3^d July 1895 was growing perceptibly smaller and the cleft of 1887 which was at the edge of the crater of 1872 was nearly closed. In this year the lava-hill continued growing to a height of 480 feet.

According to Mercalli the quantity of lava thrown out during the eruptive period of 1895-1899 amounted to about 100 million of cubic metres, that is five times as much as during the eruption of 1872, but the 20 million of cbm. of lava, were then thrown out, in less than 48 hours and the current was exceedingly strong; instead of which the 100 million cbm. were emitted during the space of 4 years and 2 months. While the lava was slowly diminishing, the dynamic force was concentrated in the central crater where the activity of the volcano was moderate and one could only remark emissions of gas and vapour and jets of sand, lapilli and scoriae, which began to fill the crater.

The filling in of the crater, having been occasioned by fragments not cohering together in their composition, one remarked at more or less short intervals sinkings of the ground and then again elevations so that the latter being the stronger one could

foresee that the explosive power, would increase and so give occasion to another explosive phase; and in fact on the 24th of April 1900 the dynamic force augmented and bombs of scoriae were thrown up; this explosive force went on increasing up to the 4th May to such an extent, as to be dangerous to those who wanted to approach the edge of the crater.

This explosive period was luckily for science observed and studied by the worthy scientist Prof. R. V. Matteucci who is at present the Director of the observatory of Vesuvius.

On the 5th the tourists, who were climbing to the top, hoping to see one of the most glorious and rarest of sights, had to stop at the Piano delle fumarole, at the edge of the ancient crater of 1872 about 300 feet from the active crater, for fear of being struck by the burning masses thrown out by the latter.

On the 6th it was impossible to go beyond the guide's cottage which stands at 710 feet below the crater as some of the masses thrown out, came even down to the higher funicular Station.

The explosions were more frequent and active, and often one could hear rumbling followed by jets of incandescent matter.

The dynamic force continued increasing, and on the 7th the projectiles went even beyond Cook's Station, so that the traffic had to be stopped, and at night the explosions increased so much, that even the guides and the employés of the funicular railway had to leave the upper station for the lower. The dynamic force was growing always stronger and on the 8th one could see from Naples and its surroundings an immense quantity of black smoke which at night being mingled with incandescent blocks thrown to an enormous height, looked like the most glorious fireworks, the whole cone seemed to be on fire. At 3 o'clock there was a violent storm, with much rain. On the 9th the activity was very great, and with the explosion one could hear shots which resembled those of cannons of great calibre. Meanwhile at the cone and at the lower stations one only noticed trembling of the ground but no real earthquake. Neither at Naples, nor at the places of the foot of Vesuvius was anything felt. On this day several big blocks fell at the foot of the cone some even of the weight of 50 Kilogr.

The largest of these blocks was calculated by Prof. Matteucci to measure 12 cubic metres and therefore to weigh about 30,000 kilograms. Towards evening both fog and rain prevented the cone from being seen, the explosions were heard, and it could be remarked that the intervals between them were greater. On the

10th the intervals were even longer, and in the afternoon they became longer still.

On the 11th and 12th the explosions had very nearly ceased, only vapour of sulphurated Hydrogen was developed and thus Vesuvius was in the so called sulphuric activity. — During this period of great activity, there was no emission of lava; Vesuvius did not return to complete calm, but had periods of activity of only slight importance. From the 2^d September and during the following days the activity of the Volcano began to augment, on the 6th fissures could be seen, and frequent rumblings were heard followed by jets of incandescent stones, on the 9th there were only 5 fissures. The dynamic force was very powerful on the 12th, but began to diminish from the 13th on. The cone had risen several feet above the edge of the crater. The height of Vesuvius was in May, at the time of the eruptive period, according to A. Fichter, topographer to the Royal Military Geographical Institute, who was busy with the basrelief of Somma Vesuvius, about 3885 feet above sea level, on the 14th of June about 3909 feet, on the 15th September the height was 3930 feet. The internal eruptive cone had three fissures of which only one was active. From the 15-30th September and during all the month of October, the activity was very slight, and so made it possible, to observe the interior of the crater from fissures of which only a little smoke and vapour was emitted.

On the 6th November the Volcano seemed to be roused from its sleep and on the 7th mighty explosions took place, so loud that they were heard in all the places at the foot of Vesuvius and blocks of more than a hundred weight were thrown into the air. This second eruptive period, with a few intervals lasted until the 29th of November and as there were only emissions of scoriae, lapilli, bombs and sand but no lava, so the eruptive cone kept on growing and at the beginning of December Vesuvius measured from 3999 to 4014 feet.

The explosive activity of Vesuvius continued with small intervals, but with less intensity in 1901, than during the previous year. But if its dynamic force diminished, the emissions of acid vapour and gas were most abundant. The soil at its foot was greatly damaged by showers of caustic or acid water, and the crops were destroyed. From November 1899 up to this year the height of the cone had increased 120 feet, but towards the end of it, had decreased again several feet. The dynamic force of the crater was less in 1902, than it had been in 1901, during which

year, there had been more lava, and the explosions were slight. From the 5th-8th September there was a slight explosive phase, beginning with explosions of incandescent matter and ending with ashes. Then during the last days of December, there were volcanic explosions. During this year parts of the edge, and of the inner sides of the crater crumbled down several times.

After March the height of Vesuvius diminished to 4020 feet, but the circumference of the crater increased, although its depth diminished owing to the accumulation of matter thrown out, during the Strombolian explosions.

Towards the end of the year the bottom of the crater sank considerably, and an explosive period commenced, which became very violent during the first month of 1903. In fact during the whole year, with only short pauses between, Vesuvius was in a state of activity. Mercalli states that during the first six months there were 137 days of explosive activity with only 37 of pause. According to this author, these 137 days are divided into 5 phases differing in their nature and intensity as follows ;

I. From 1st of January—20th of February moderate explosions with slingt detonations, emissions of gas and vapour without lava (volcanic phase) then explosions of projectiles (Strombolian phase), finally all together.

II. From the 21st February —8th of March, Strombolian phase exclusively.

III. From the 9th of March to the 15th of April, a most violent explosive phase which was firstly Strombolian and secondly volcanic.

IV. From the 18th of April to the 11th of May another explosive phase took place, which, during the first few days, was Strombolian and then exclusively volcanic.

V. From the 18th to the 30th of June a violent Strombolian phase began, which ended with an efflux of lava in the month of August.

The quantity of matter thrown out during the explosions of March-April was calculated by Mercalli to about 401,000 cbm.

The dynamic force of the crater was violent in July, rumblings being heard at Resina, Cercola, Ottajano and several other places at the foot of Vesuvius.

On the 20th of July the efflux of lava began wich filled the Atrio between the cone and the edge of the ancient crater, and then overflowed the outer side of the large cone. This lava during the following days, flowed slowly down in the direction of

Torre Anunziata damaging Fiorenza's mule path, and stopped on the night of the 26th when a new efflux of lava was observed at the edge of the crater, which descended in the direction of the guide's new cottage which it threatened, but, after having destroyed the wall surrounding the cottage, it stopped.

During the following days, other small streams of lava were observed which suddenly ceased.

On the 12th of August another efflux was observed at the edge of the crater. The explosions continued. The small cone had lost a little in height, but its mouth had grown much larger. The lava in the crater increased immensely, and reached a height of more than 3975 feet above sea-level. On the evening of the 25th of July, the Strombolian explosions ended and the hillock of lava lessened in height. On the following morning the great cone opened at about 3450 feet above sea-level and from the fissure, which was from 10-12 feet wide, lava burst forth with a loud detonation.

In the afternoon another stream of lava flowed in the direction of Cook's Funicular railway, and as the slope was very steep, rapidly reached it.

On the morning of the 27th the side of the great cone opened towards east north east, at about 2400 feet above sea-level in the Valle dell'Inferno, and lava began to flow most abundantly from three fissures at the same time. The bottom of the crater sank to the depth of 390 feet. On the 31st of August the volcano was quiet, but on the 2nd of September the flow of lava recommenced. During the entire month of September the emission of smoke, white at first, and afterwards black, because of the ashes, lapilli and lava were most abundant.

On the 14th-16th there was again a flow of lava in the Valle dell'Inferno. From October to December there were volcanic and Strombolian explosions.

Lava continued to flow into the Valle dell'Inferno, and extending even to Mount Somma and forming a lake of fire, which could not always be seen from Naples, but from Boscotrecase one could distinguish the glare. This lake was 3000 feet long and 900 feet broad. Fortunately this lava caused no damage as it only covered sterile ground.

This lava went on increasing, and continued to flow until May 1904. On the 2nd of May, at the north west side of the mountain a series of radical fissures opened, from which small quantities of lava flowed at intervals, and by the end of the year,

reached, at times, the Atrio del Cavallo, and the electric railway of Cooks Funicular, cutting the road on several occasions.

In the year 1905 the intensity went on increasing, and the lava-currents multiplied and flowed over the former lava, which was still warm, thus filling in the depression of the Atrio del Cavallo which is behind Monte Umberto. The lava took different directions, so that several times it seemed, as if it was going to fall into the Fosso della Vetrana.



MOUNT VESUVIUS 1905.
Plate 15.

And now in the year 1906 on the 4th of April began that terrible eruption, which was far worse than that of 1872 and which we can only compare to that of 1631.

On the 4th of April 1906 an eruptive phase began, so violent as to frighten the inhabitants of Naples, and still more, those of the places at the foot of Vesuvius. On the afternoon of the same day, the famous pine of smoke was seen from Naples on the top of the mountain, a much dreaded appearance, as it is always the forerunner of a great eruption. This gigantic column of black smoke rose to a height of more than 3000 feet. This was caused by the falling in of the summit, and of a fissure which had opened on the south-south east side of the cone at about 3600 feet above sea-level, from which a flow of lava issued, which ran in the

direction of Fiorenza's house. The same evening, about 10 o'clock p. m. heavy black sand, first in small quantities and then in larger ones, always increasing, fell in Naples during the entire night until 11,30 a. m. of the 5th.

On the 6th after a short pause, this fissure widened and another one opened at about 2400 feet above sea-level, and from this opening lava flowed in the direction of Boscotrecase, and then emissions of sand recommenced from the cone falling on the surrounding districts of Vesuvius and also on Naples.

On the 6th other fissures appeared, and the former ones widened. From one, near Cagnoli at about 1800 feet in the direction of the two first fissures, a torrent of lava issued which flowed in the direction of the cemetery of Boscotrecase. From the central cone explosions were heard even more violent than usual on account of the great quantity of vapour, and sometimes even lava was thrown out and fell at some distance from the cone.

On the afternoon of the 6th the illustrious Prof. Bassano of the Royal University of Naples and his assistant Dr. Galdieri noticed, that two currents issued from the last fissure, one going eastwards, and the other towards Casa d'Aponte, the latter destroying some cultivated ground, and a few cottages. The lava flowed slowly and the surface was covered with scoriae. On the 7th a pause seemed to take place in the volcano's activity. In the afternoon the lava had reached a point between the cemetery of Boscotrecase and the Cellari d'Argano, having covered two Kilometres in 24 hours. The above mentioned scientist remarked that the dynamic force of the crater had so much diminished that it seemed as if the danger for Boscotrecase was over.

This pause was only fictitious, as at 8 o'clock the dynamic force began to make itself apparent by violent explosion, and by throwing out enormous incandescent projectiles which fell on the N. E. side. A great quantity of these fell on the edge of the cone, giving it the appearance of burning all round. Another portion of them fell on the sides of the mountain. The explosions were followed by thick, black clouds of vapour furrowed by lightning. This magnificent sight could not be seen, except by those who were near the mountain, as the thick clouds came between it and Naples, and it was only at rare intervals that even they were able to witness the activity of the principal crater.

At 10 o'clock a fourth fissure opened lower down than those of Cagnoli, which threw out lava in the direction of Terzigno, and the current of Boscotrecase became more active, invading Ora-

torio and destroying houses, factories and cultivated land and taking the direction of the cemetery of Torre Annunziata.

Between midnight and dawn of the 8th the intensity was greatest. Incandescent matter, lapilli and, sand were thrown to a height of. 4500 feet and even more, and impelled by the wind, fell on Ottajano, destroying almost this flourishing town which lies at 5 kilometers distance from the mountain, and greatly damaging S. Giuseppe, Somma and S. Anastasia. Lighter portions were blown further by the wind, and fell on the other parts at the foot of Vesuvius, and principally on Torre del Greco, in which, on the 10th, only about twelve people remained.

During the night of the 8th - 9th ashes fell abundantly in Naples. It seemed almost as if its last hours had come. The streets were deserted, and the pale electric light could scarcely be seen through the mist of ashes. The church-bells rang as if appealing to Heaven for help, but their sound was damped by the rapid and silent fall of the ashes. In the morning the whole city was covered several inches deep with them. People, wearing mostly blue spectacles to protect their eyes, walked with open umbrellas, and the ladies wrapped themselves in veils to protect their eyes and complexions.

At Torre Anunziata neither ashes nor lapilli fell, but the town was threatened by the lava. Prof. Matteucci, director of the Observatory, went down to Boscotrecase during the early part of the evening of the 7th in order to study the course of the lava, and to see which places were most threatened. The fissure suddenly opened with such a violent explosion, that the whole mountain trembled. But, although he could hardly see, and the fall of incandescent matter was very great, the brave scientist hastened back to the Observatory. When, after the greatest difficulty he got to Salvatore hill, he as well as the employès, and the Carabinieri who were there, were forced to leave the building at once, as enormous stones and lapilli were falling on its roof with such violence as to beat it down. The terraces also, and the barracks of the Carabinieri were almost demolished. They had to go down beyond Cook's Hotel, and take shelter in some caves which had been dug in the ancient lava.

All the night through violent explosions were heard, and not only by those at the foot of the mountain but even at Naples where some trembling of the ground was felt. Prof. Di Lorenzo says, that even at the distance of 20 Chilometres tremblings of the ground followed the explosions.

On the 8th the much dreaded pine was seen hovering over Vesuvius. It formed a gigantic column of more than 12000 feet in height. At the summit it had the appearance of an enormous cauliflower which widened as it was forced upwards by the quantity of gases it contained, thus growing even larger and more terrible. It took a greyish tint from the sun's rays.

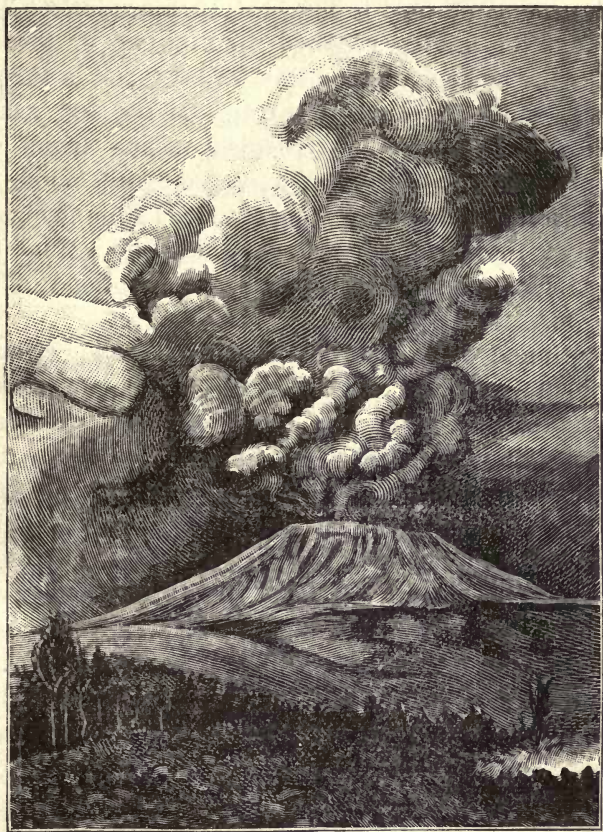
Flashes of lightning, electric fluids followed by terrific thunder, were seen and heard, and at the same time, a few drops of hot acid water, sand and lapilli fell to the ground. From Torre del Greco, going towards Vesuvius, one could distinctly smell a strong odour of sulphur. In the afternoon it was quite impossible to reach even the white house which is just over Boscotrecase, and during the whole of the day, the cone was invisible. It was thus impossible to know what had happened to Cook's lower funicular station. Some days later it was seen that it as well as all the machinery and rails which lead from the Hotel to the said station had been quite destroyed.

At Naples, all day long, sand continued falling, and towards evening it fell with such impetuosity that, from Portici on it was nearly impossible even for horses to proceed. The wind being very high this sand was blown into the eyes causing much suffering. While sand in more or less quantities, was falling in Naples, in other places at a greater distance from Vesuvius, sand and ashes of a lighter composition were falling carried along by the south wind, and the ashes, being so very light, invaded the whole province of Caserta, crossed the Appennines and the Adriatic and fell on Montenegro and even farther.

The masses of vapour, sand, ashes and lapilli caused by the crumbling down of the cone, which again, was caused by the overflow of the lava of the previous evenings, had stopped up the lava-canal, and the vapour, being thus compressed, pushed the obstacles into the air, and thus produced to rain of ashes and sand which, from the evening of the 8th went on increasing during the following days.

In the morning of the 9th the direction of the wind had changed from south to north, and the ashes which were constantly falling, were impelled towards the sea. The terrible black pine bent over towards Capri and Ischia and the middle of the Bay throwing showers of ashes, lapilli, and sand over Torre del Greco, Resina, Portici and Naples. It was as dark at midday as if it were already night. Torre del Greco, Pompeii, and Castellammare di Stabia were exempted from this infliction. The thick

cloud that darkened the road between Torre del Greco and Torre Annunziata, prevented even carriages from passing, and only a few brave people and soldiers had the courage, to face the darkness and the thick rain of ashes, in order to bring help to those poor unfortunate beings who had not been able to escape the danger. The road was quite deserted on that day. No one was to be seen,



ERUPTION 1906.
Plate 16.

excepting a few fugitives who, not until the last moment seeing death before them, decided at last to give up their homes, in order to save their lives. The look of terror on their faces, especially on those of the women, can scarcely be described. They had covered their heads with their skirts and each carrying a child or a bundle in her arms, was hardly able to say anything but « *Madonna mia, save us from the mountain.* »

(In the lower classes Vesuvius is simply called, the mountain).

The Circumvesuvius electric railway could proceed by taking the utmost precaution, as it was scarcely possible to see in what state the road was in. It grew so dark, that one could only see the shadow of the lights from the electric globes, and during some hours, even those lights were invisible. On that day the lava from the Oratorio of Boscotrecase surrounded the latter on two sides, and then descending on the Circumvesuvian railroad, destroyed it, and continued to flow in the direction of Torre Annunziata. But, after having reached the first two or three houses, it ceased flowing, when another flow of lava run in the direction of the railway station of Torre Centrale. On the 10th ashes began again to fall, but this time of a reddish colour which gave the country the appearance of being covered with blood. Vesuvius had short paroxysm, but their intensity was diminishing. On the 11th of April at 10 am., it was so dark at Naples, that the street lamps had to be lighted. The same had to be done also on the 12th at 4 p. m.

This continued rain of ashes began to make circulation in the city difficult, and the darkness gave a most disconcerting feeling. At certain times it was even difficult to breathe. This lasted from the 9th to the 12th. Strangers, and many of the Neapolitans who could afford it, left Naples for the neighbourhood which had not suffered from the eruption. A good number escaped to Rome. The inhabitants of the place at the foot of Vesuvius came to Naples for shelter. On the 13th scarcely any ashes fell in Naples, but, the wind having changed, they fell on all the places at the North side of Vesuvius. The colour of the ashes changed again. No longer red, it was greyish and lighter in weight. The « pine » still rose majestically into the air to a height of 12000 feet. The dynamic force of the crater meanwhile, was slowly diminishing. Here and there lava ceased flowing, but the rain of ashes blown by the various wind, now to right and then to left, fell heavily on all the following places at the foot of the mountain Pollena, Trocchia, Cercola, Torre del Greco, Resina, Portici excepting Ottaiano and S. Giuseppe, which were almost quite destroyed by lapilli during the night of the 7th and 8th of April. When, after such a long interval, it was possible at last to see Vesuvius from Naples, it had quite a different appearance to its former shape before the eruption, being now 450 feet smaller, and having a much wider opening caused, of course, by the fragmentary matters thrown up during the eruption.

From the 15th April up to the last days of the month the vulcano continued sending up greyish ashes, very little of which fell at Naples. From the 17th to the 20th April it was only the ashes which had fallen on the roofs of the houses which the high winds were scattering about. On the 26th a large quantity fell again on Naples, coming directly from the crater, as parts of the edge of the same were crumbling down.

On the 20th the pine of smoke was only 2730 feet.

One most important fact must be noticed, and this is, that the quantity of lava emitted during this eruption was small in comparison with that thrown out during the great eruption of 1872, and the damage caused by it, was relatively small. But there were other damages which extended over an immense area, caused by the great quantities of fragmentary matter thrown out, which, destroyed nearly the whole of Ottajano and a large part of S. Giuseppe and Somma, and damaged many buildings at Torre del Greco. The soil was, so to say, quite destroyed, as not only the crops of this year suffered, but in some places the ground was covered by such a quantity of lapilli, that the fruit trees were ruined and the cultivation of the soil was stopped not only for this year, but for many a one to come. The lapilli that fell at Ottajano were, on an average, about a centimetre in size, some even larger, and some as big as an apple. The quantity between the 7th 8th April fell to a metre in depth. The roofs of the houses fell in under the great weight, and crushed the other ceilings down to the ground floor. Nearly all the churches were destroyed, perhaps on account of their age or by the quantity of lapilli which fell on the roofs. As frightened masses of people, at the beginning of the eruption, rushed into the churches to pray, many were killed by the falling roofs, as happened at the church of S. Michele at S. Giuseppe, where there were hundreds of victims.

In order to give an idea of the quantity of ashes emitted by Vesuvius during this last eruption, let us quote some dates as to the ashes fallen.

From 7 a. m. of the 10th to 7 a. m. 17th from the 12th to the 12th, from the 12th to the 13th always at the same hours.

From the 10th to the 11th millim. 5 weighing Kilograms 3,27 for square metre

"	"	11 th	"	12 th	"	5	"	"	3,28	"	"	"
"	"	12 th	"	13 th	"	5	"	"	3,29	"	"	"

Multiplying the surface of the city of Naples 18 millions square metres for the medium of the weight of the ashes fallen in these three days we have $18,000,000 \times 3,40 = 612,000,000$ Kilog. equal

to 61200 tons of ashes, fallen in three days in the streets, roofs and terraces of Naples.

Clouds of black smoke were thrown out from time to time followed by rains of ashes. Sometimes bombes of ashes were thrown out which, falling on the side of the cone, stirred up the ashes which had formerly fallen and made thus a long stream which, in the daytime, resembled a new current of lava running precipitously down to the foot of the mountain.

During this eruption, especially on the most terrifying days 7th, 8th, 9th, 10th and 11th of April processions of people chanting and praying could be seen in nearly all the streets of Naples, some carrying the image of S. Januarius, their patron saint, others with crucifixes borne aloft. At Boscotrecase, as the lava was coming with such violence towards the town, the frightened inhabitants brought in procession the statue of St Anna to the flowing lava, and the people kneeling down, prayed for help.

On the 9th April their Majesties King Victor Emanuel III and Queen Elena, came from Rome and went at once to all those places which had been damaged and destroyed, helping every where with word and deed.

The Royal Palace at Naples, as well as the Barraks and all the public buildings were, by order of the king, opened to all the fugitives who came, in thousands to take refuge in Naples. H. M. Queen Elena devoted herself for many days to those poor people, visiting them, speaking words of comfort and seeing that they received food and clothing and helping everywhere.

A beautiful example of self denial was given by H. R. H. the Duchess of Aosta Helène of France. From the very beginning of this terrible eruption up to the very last, H. R. H. could be seen every day in one or the other of those places, which had been destroyed, helping where ever she could. Riding on carts, on mules, going even on foot in dangerous places, risking her own life, just to save a life, or to bring help and encouragement to those poor beings, who so much needed a word of sympathy in those moments. In the mean time H. R. H. the Duke of Aosta, at the head of his brave soldiers, was always to be found where help was needed. Detachments of the Neapolitan Red Crosse were sent to all those places, especially to Ottajano where help was mostly wanted, and it was a real blessing to those poor inhabitants, to receive so much help and that at the right time.

At Naples the Archbishop Cardinal Prisco, the local Authorities, the citizens of Naples all contributed with magnanimity in

bringing help to the poor fugitives. After some time the terror of the Neapolitans and of the inhabitants of the places at the foot of Vesuvius began to abate.

The fugitives returned to their native places, where the charity of the whole world had provided homes and food for them; and now already one can see at Ottajano new houses which are being built and with this fresh hope comes again, that every thing may once more return to its former flourishing condition.

The fog which had during nearly the whole eruption prevented Vesuvius from being visible from Naples, had at last disappeared. What a change had taken place during this time. The physiognomy of Vesuvius had entirely changed. the traditional beautiful column of smoke had disappeared and the entire mountain was covered with a dull white wrapper caused by the greyish ashes, which lay thick up on it, and covered up every trace of green life. It was observed that Vesuvius had grown smaller than Somma.

After this violent paroxysm the Volcano fell into a deep slumber. In May rumblings were heard again, caused by the crumbling down of the edge of the crater and thus widening it still more by the side of Cagnoli di Ottajano but no lava was visible in the interior of the crater.


The giant sleeps once more again, but the Hephaestus of old is not yet dead and although slumbring by the moment at his forge, he may awake at any time, and cause the fires of his furnace to blaze up anew.

FINIS.

List of the books consulted for this Work

- ABICH. H. — Ueber den Ausbruch des Vesuvs 1857. (Berlin).
- AGRICOLA G. — De Natura eorum quae effluunt a terra 1545.
- ALVINO FR. — Eruzione del Vesuvio dell'anno 1784.
- ARACRI GREG. — Relazione della pioggia di cenere avvenuta in Calabria
ulteriore 27 marzo 1809.
- ARCONATI DI VISCONTI — Appunti sull'eruzione del Vesuvio 1867-1868.
- AULDJO I. — Sketches of Vesuvius with short accounts of its principal
eruptions. London 1833.
- BARONIUS — Vesuvi montis incendium Napolis 1533.
- BASSANI F. e GALDIERI A. — Notizie sull'attuale eruzione del Vesuvio
(Aprile 1906). Rend. R. Acc. Sc. di Napoli. 1906.
- » Sulla caduta dei proiettili Vesuviani in Ottaviano durante la
eruzione dell'Aprile 1906. Rend. R. Acc. Sc. di Napoli, Lu-
glio-Agosto 1906.
- BEULÉ - Les drames du Vésuve. Paris 1868.
- BRACCINI I. C. - Dell'incendio fattosi nel Vesuvio 16 di Dic. 1631, e
delle sue cause ed effetti. Napoli 1632.
- BREISLAK SCIPIO E WINSPEARE ANT. — Memoria sull'eruzione del Ve-
suvio accaduta la sera di 5 giugno 1794. Napoli.
- BULLIFON A. — Lettere memorabili. Napoli 1693.
- CAPOZZI — Rendiconti accadem. delle scienze. Napoli 1896.
- GERASO FR. — L'opere stupende e maravigliosi eccessi della natura
prodotti nel monte Vesuvio della città di Napoli 1632.
- COLLETTA P. — Storia del reame di Napoli. Capolago 1838.
- CRONACA dell'Anonimus Cassinensis.
- DAMIANO S. PIER — Narrativo breve de maravigliosi esempi occorsi
nell'incendio del monte Vesuvio circa 1038.
- DAUBENY - Eruption of Vesuvius, Napoli 1834.
- DE BOTTIS - Dell'incendio del Monte Vesuvio accaduto nel mese di
ottobre del 1767. Napoli.
- DIODORUS SICULI - De antiquitatis.

- DIONIUS CASSIUS — *Historia Romana*.
- FRANCO P. e GALDIERI A. — L'eruzione del Vesuvio del mese di luglio del 1895.
- FUCHS — *Vulkane und Erdbeben* 1881.
- » *Vulcani e terremoti*. Milano 1881.
- GALENUS — *Scripta minora*.
- GAUTHIER Prof. VINCENZO — *Manoscritto* 1906.
- HAMILTON SIR. W. — *Observations on mount Vesuvius and mount Etna*. London 1774
- HAMILTON SIR. W. — *An account of the last eruptions of Vesuvius*. London 1774.
- HEIM ALB. — *Der Ausbruch des Vesuvus im Jahre 1872*, Basel 1873.
- LEONE AMBROGIO — *Storia di Nola e del Vesuvio*. Venezia 1517.
- LUCRETIVS CARUS — *De rerum natura*.
- MAURI ALESS. — *Memoria sull'eruzione Vesuviana di 21 Ottobre 1822*. Napoli.
- MARTINO DE CESARE — *Osservazioni giornali del successo del Vesuvio dalli 16 Dicembre 1681 sino al 20 Aprile 1682*.
- MATTEUCCI R. V. — *Sul periodo di forte attività esplosiva offerto nei mesi di Aprile-Maggio 1900 dal Vesuvio*. Boll. Soc. Sism Ital. VI 1901.
- » *La fine dell'eruzione Vesuviana 1891-94*. Ibid
- » *L'apparato dinamico della eruzione Vesuviana del 3 Luglio 1895*. Rend. R. Acc. Sc. Napoli 1897.
- MACRINO G. — *Vesuvio*. Napoli 1693.
- MECATTI G. M. — *Racconto Storico filosofico del Vesuvio* 1752.
- MECATTI — *Osservazioni fatte sopra il Vesuvio del mese di Marzo 1742-1754*.
- MERCALLI P. — *Notizie Vesuviana 1896-1900*. Boll. Soc. Sism. Italiano VI. 1900.
- » *Notizie Vesuviana 1900-1905*.
- MONITIO C. — *La taglia ove si continua la fiasca con le lacrime del Vespo furioso*. Napoli 1647.
- MONTICELLI — *Storia di fenomeni del Vesuvio avvenuta negli anni 1821-1822 e parte del 1823*. Napoli.
- OLIVIERI G. M. — *Breve descrizione istorica fisica dell'eruzione del Vesuvio di 15 giugno 1694*.
- ONOFRIO ARCANGELO — *Relazione ragionata dell'eruzione del nostro Vesuvio nel dì 15 giugno 1794*. Napoli.
- Ordinaire C. N. chanoine-Histoire naturelle des volcans. Paris 1737.
- PALMIERI LUIGI — *Memoria sull'incendio Vesuviana del mese di Maggio 1855*.
- » *Alcune osservazioni sulla temperatura delle fumarole* 1857.
- » *Il Vesuvio e la sua storia*. Milano 1880.
- PARRINO DOMENICO A. — *Narrazione dell'eruzione del Vesuvio nel 1694*. Napoli.

- PARROTTI A. — Discorso astronomico sopra di quattro ecclissi del 1642. Napoli.
- PHILIPPS IOHN — Vesuvius. Oxford 1869.
- PIGONATTI ANDR. — Descrizione dell'eruzione del 19 Ottobre 1766. Napoli.
- PLINIUS C. Sec Epistularum.
- PORRATA SPINOLA — Discorso sopra le origini dei fuochi gettati dal Vesuvio. Lecce 1632.
- PLUTARCUS — Moralia.
- PROCOPIUS CESARE — De bello Gothorum.
- Rath vom Der Vesuv. Berlin 1873.
- RECUPITO G. C. — De Vesuviano incendio 1632.
- » Relazione dell'incendio del Vesuvio seguito 1682 del 14 di Agosto sino ai 26 dell'istesso. Napoli.
- ROTH I. — Der Vesuv und die Umgebung von Neapel. Berlin 1857.
- SCACCHI ARC. — Storia dell'eruzione del Vesuvio. Napoli. 1848.
- SCHMIDT I. F. I. — Vulkanstudien. Leipzig 1870.
- » Die Eruption des Vesuvs in Mai 1855. Wien, Olmütz 1856.
- SCROPE POULETT — Ueber Vulkane. Berlin 1872.
- SORRENTINO — Istoria del Monte Vesuvio. Napoli 1734.
- SERAO FR. — Storia dell'incendio del Vesuvio. 1737 Napoli.
- » Incendio. Napoli 1773.
- SIGONIUS — De Impero occidentalis.
- SIGONIUS — De Regno Ital.
- Storia Naturale — Neumayer Vol. I, 3. Milano.
- STRABONIS — Geografia.
- SUETONIUS C. — Caesarum XII Vitae.
- SUPO PATER — Giornale dell'incendio del Vesuvio dell'anno MDCLX con le osservazione matematiche. Roma, presso De Lazzari.
- SUPO PATER — Continuazione del prossimo incendio del Vesuvio con gli effetti delle cenere e pietre da quello vomitato e con le dichiarazione ed espressione delle croce meravigliose apparsi in varil luoghi dopo l'incendio. Napoli. Giovanni Francesco Paci 1661.
- TATA abate — Relazione dell'ultima eruzione del Vesuvio nella sera del 15 Giugno 1794. Napoli.
- TATA — Relazione del grande incendio del Vesuvio successo nel giorno 8 del mese di Agosto 1779. Napoli.
- TORRE della Gio. M. Prof. — Storia e fenomeni del Vesuvio 1755 Napoli.
- TORRE DELLA DUCA — Lettera prima lettera seconda sull'eruzione del Vesuvio di 15 Giugno 1894 Napoli.
- VITRUVIUS MARZ — De architettura.
- XIFILINUS — Storia Romana.
- 

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